CHINESE WRITING SYSTEMS FOR VISUALLY IMPAIRED PERSONS: ANALYSIS AND ASSESSMENT.

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ABSTRACT

The purpose of this study is to analyse and assess Chinese writing systems for visually impaired persons.

The study provides a general description of the Chinese character script, the reform of Chinese language and the reform of Chinese character script. It reviews past and contemporary Chinese writing systems for visually impaired persons and gives a general description of the currently used Chinese writing systems for visually impaired persons.

The different Chinese writing systems for visually impaired persons are discussed and the nature of the relationship between speech and writing in Chinese is taken into account. The discussion concludes that change to the existing writing systems for visually impaired persons is essential in order to provide for the full and equal participation of visually impaired persons in Chinese society and culture.

The theoretical possibilities for achievable and worthwhile improvements to the systems are assessed. The assessment is set in a wider context by taking into account developments in other societies, notably Japan and Korea, where there are similarities in problems associated with non-alphabetic scripts. Developments in communications and computer technology and their relationship to visually impaired users are also considered.

The results of field research conducted in China, Hong Kong, Taiwan and Britain are used to put these assessments into perspective. The field research constituted a pilot study since no previous such studies had been made. It was concerned with visually impaired users' perceptions of Chinese script and Chinese writing systems for visually impaired persons.

The thesis of this work is that significant improvements could be brought about by changing Chinese writing systems for visually impaired persons. Key issues for such improvements are identified and a framework for change is established. To illustrate the framework and the issues which might arise in its implementation 1000 Chinese characters have been encoded with Braille symbols but no attempt has been made to achieve a comprehensive encoding. This could and should be left to bodies in China, entrusted with the detailed elaboration and practical implementation of the changes.

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Technical Notes

1.) Chinese Phonetic Transcription

For the transcription of Chinese names and terms, *hanyu pinyin*, the official phonetic transcription of the People's Republic of China, will be used in this study, unless indicated otherwise. (see technical notes on bibliography).

2.) Chinese characters

Chinese characters will be used in the text:

- when a Chinese word or name is used in the text for the first time,
- if they are needed for the comprehension of quoted or translated parts.

Chinese characters will be used in the bibliography:

- to reference Chinese works.

Chinese characters will be used in the appendix:

- for all material which was produced and used in Chinese.

3.) *Jiantizi, fantizi* and missing characters.

The Chinese computer system used for this thesis is E.T. 1.60. The system originally provides *fantizi* but is equipped with a separate font for *jiantizi*. It was intended to write all Chinese characters in this thesis as *jiantizi*. Technical problems made it necessary to use *fantizi* in the written text page 1 to page 248 but, *jiantizi* could be and are used in the appendix. The *jiantizi* provided by E.T. do not always fully comply with the regulations in the P.R.C. Furthermore the font for *fantizi* and the font for *jiantizi* did not provide all required characters. Where characters are missing due to this technical problem the position is marked with a * followed by a superscript number (for example: *[1]). The missing characters are provided in handwriting under the heading "Missing characters" in the appendix, ordered according to the numbers which follow the asteriks.

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FOR HANNI

Introduction

This study originated from just one, very simple, question. "What writing system for visually impaired persons is used in China?" The attempt to answer this question led to the discovery that no information was available in the West on what systems were in use in China and this fed the desire to make available to the Western reader a comprehensive description of Chinese writing systems for visually impaired persons. Whilst seeking the sources for such a description, a problem, so far apparently untouched, began to emerge. In the attempt to address this problem it became evident that sometimes a subject is so unique, a problem so untouched, that in order to address such a subject and discuss such a problem, science has to return to its very basis, the desire to learn and observe and the power of reason. This study is underpinned by this fact, especially in as much as it can draw very little on previous works and in as much as the study itself has become part of the developments it observes. The problem which emerged concerned the relationship between Chinese character script and currently used Chinese writing systems for visually impaired persons and it was to become the centre of this thesis.

The purpose of this study is therefore to analyse and assess Chinese writing systems for visually impaired persons. The main task is to clarify the relationship between Chinese script and Chinese writing systems for visually impaired persons and to discuss the implications of this in order to overcome an ambiguity which has existed and remained apparently unquestioned for more than a century. The study

attempts this not only in order to provide the Western reader with a comprehensive overview of Chinese writing systems for visually impaired users but in order to start to eliminate the discrimination against visually impaired persons which results from the relationship between Chinese script and currently used Chinese writing systems for visually impaired persons. The study therefore lays the foundation for what should become a continuing field of research.

In the West documents about Chinese writing systems for visually impaired persons are scattered and scarce and with very few, and almost insignificant, exceptions the subject has not been discussed at all. In China itself documents are usually available at specialised schools for visually impaired persons but no comprehensive documented discussion of the systems was found. A wide-ranging search of sources, mainly in China, enables the study, however, to review past and contemporary Chinese writing systems for visually impaired persons and to place this issue into a wider context of related discussions.

China has an estimated population of 7.5 million visually impaired persons. More than 80% of them live in rural areas and the majority are elderly. Provisions for visually impaired persons are available mostly in urban areas. About 3% - 10% of visually impaired children of school age receive education of some sort.

This study begins by explaining the fundamentals of Chinese character script in general and the characteristics of Chinese characters in particular. The political importance and sensitivity of changes of language, written style and script in China are illustrated and discussed. This is set in a wider context by discussing other forms of communication where Chinese character script is coded and transmitted.

Following this, a brief introduction into communication systems for visually impaired persons is given. The writing system for visually impaired persons with which the thesis is predominantly concerned is identified and explained. This system is *Braille* script. The study then gives a brief history of Chinese writing systems for visually impaired persons. Due to restrictions of time and availability of resources this study concentrated its search of historical sources on the Mainland and a further search for historical sources in Hong Kong and Taiwan is proposed. The study does provide a description of the Chinese writing systems for visually impaired persons which are currently used in the People's Republic of China, Taiwan and Hong Kong and of the system which is suggested for immediate implementation in the People's Republic of China. Questions concerning Chinese writing systems for visually impaired persons are placed in a wider context by introducing systems for visually impaired persons from other countries which enable them to communicate in Chinese character script.

After this introduction to Chinese script and Chinese writing systems for visually impaired persons the study explores the implications of the

relationship between them. For this the terms equality, literacy and illiteracy are defined. The conclusion of this exploration makes it imperative to discuss possibilities for representing Chinese character script with a writing system for visually impaired users. The study discusses such options in order to establish the potential for reform.

The study then presents the results of field research undertaken in order to investigate the perceptions of Chinese characters and its representations by users of writing systems for visually impaired persons in China. This is done in order to address the lack of available data as well as in order to test the hypothesis contained in the previous discussion.

The study concludes with a practical suggestion to overcome the fundamental problem raised during the preceding discussion. The practical suggestion involves the encoding of 1000 Chinese characters in Braille.

This study hopes to contribute to efforts concerned with the abolition of problems which are created by the relationship of Chinese character script and Chinese writing systems for visually impaired persons.

Chapter 1 Chinese script

In this chapter the fundamentals of Chinese character script in general and the characteristics of Chinese characters in specific are explained. After this the political importance and sensitivity of changes of language, written style and script in China are illustrated and their impact on the subject of the thesis is discussed. Finally this is put into a wider context by discussing other forms of transmitting writing in Chinese character script.

1.1 Fundamentals of Chinese character script and Chinese characters

Chinese character script is based on 'Chinese Characters'. Chinese characters are written or printed in such a way so that each takes up the same amount of space and an empty space is placed between each character. Chinese characters can easily be written in both vertical and horizontal lines. They can also be written either from left to right or from right to left. Each Chinese character has a unique form and is, with very few exceptions, pronounced as one syllable. A Chinese character represents the smallest individually meaningful linguistic unit in Chinese, the morpheme. In Northern Chinese there are 413 different syllables pronounced in 4 different tones. Syllables can, however, also appear without a distinguishing tone. In a standard handbook on China it is quoted that 1338 phonetic units (syllable and tone) are actually used (Ladstätter, 1974: 1274). The number of different characters used in a text depends on the nature of the text and the time when it was written. Taking modern Chinese, for example, a total of fewer than 10,000 different Chinese characters seem to be in regular use.

Considering the whole of Chinese written works, it is estimated that there are between 50,000 and 60,000 characters and including variations of these even up to 74,000 Chinese Characters (Huang, 1989: 51) A character may be polysemous and may have more than one pronunciation. Given the number of Chinese characters and the number of phonetic units it is clear that many characters must share the same pronunciation.

Chinese character script is not directly related to the phonology of Chinese and for this reason not directly related to historical developments of sounds or dialects. Under these circumstances Chinese character script remained fundamentally unchanged over several thousand years. Other contributing factors were the changes in calligraphy which were perhaps mainly due to a change in writing materials and of course the changes in written styles. DeFrancis concludes:

> In the three millennia and more from Shang to Qing the changes in writing were largely limited to changes in the form of the characters without affecting the basic nature of the writing system itself. (DeFrancis, 1984: 240)

Classical Chinese is a style of writing in which it is generally believed that each Chinese character is understood on its own. The turn of the century brought about a dramatic change in Chinese writing, the introduction of modern Chinese writing. Modern Chinese writing is marked by the fact that it represents words which often consist of more than one character. This change has, however, not altered the script, where a space is still placed between each character. This

means that although combinations of characters are to be understood as words the script gives no specific indication of this.

The view of Chinese characters held by the general public and most scholars is a view only concerned with the visual appearance of the character, basically a combination of strokes. Although no study provides conclusive evidence of this, there appears to be a general belief that this visual appearance is indispensable. The visual appearance of a Chinese character will henceforth be referred to as the *Corpus* of the character. Since to visually impaired persons the ink on the paper has no, or very little, meaning, a wider view has to be applied in order to understand the nature of Chinese characters. It is indeed essential to apply such a wider view in order to be able to discuss comprehensively the issue of Chinese characters relating to Chinese writing systems for visually impaired persons. This wider view considers not only the ink on the paper, but everything which relates to the characters. This includes codes for Chinese characters such as the *ASCII* code for computers, general knowledge about characters and so forth. While the visual appearance of the character will be referred to as the *Corpus*, these other aspects of the Chinese character will be referred to as the *Geist* of the character. *Geist* is a German philosophical term which can be used to refer to the opposite of material being.

In the following, firstly the *Corpus* of the Chinese characters will be investigated and then, secondly, the *Geist* of the characters.

The *Corpus* of the Chinese character is highly complex. Chinese characters are not pictographs in the sense that their meaning is apparent to everybody at a glance. Characters have long been distinguished according to certain characteristics, taking into account that characters are often complex logical arrangements of symbols. According to a current encyclopedia *Cihai* (辭海) the characters have been divided into the following six groups *liu shu* (六書) since the Zhou-Dynasty (周代 approx. 1122 - 255 B.C.). (Cihai, 1979: 783)

1.) Imitative Symbols or Images, *xiangxing* (像形): Characters which are styled upon images of real objects and can usually be tracked down to their physical origin.
2.) Indicative Symbols, *zhishi* (指事): Characters which suggest their meaning often by representation of ideas.
3.) Logical combinations, *huiyi* (會義): Characters which consist of different parts with the meaning of each part contributing to the meaning of the character as a whole.
4.) Meaning-enlargements, *zhuanzhu* (轉注): Characters which through slight changes to their original shape or combination communicate a further meaning.
5.) Phonetic compounds, *xingsheng* (形聲): Characters which consist of a combination of an element which indicates the meaning and an element which represents the pronunciation.
6.) Borrowed characters, *jiajie* (假借): Existing characters which are used to represent other ideas as well.

Use of the above mentioned groups for the distinction of characters is not universally agreed upon. The *Cihai*, for example, states that *zhuanzhu* and *jiajie* are today not used to distinguish between characters (Cihai, 1979: 783) and some authors do not use them (Wu, 1988: 15). Other authors like Wippermann referring to Kratochvil still use all six groups presumably because they were laid out in the *Shuowen Jiezi* (說文解字), the first known standard work on Chinese etymology. (Wippermann, 1985: 1)

One of the few clearly noticeable changes to the *Corpus* of the characters over the centuries, however, was the use of several styles in which the characters were written. This can to a certain extent be attributed to developments in writing materials. Generally eight styles are mentioned in the following chronological order (Wu, 1988: 31).

- Style of characters used on shells and bones – inscriptions *jiawen* (甲文),
- Style of characters used on bronze vessels and objects in the Zhou-Dynasty *jinwen* (金文),
- Great Seal style *dazhuan* (大篆),
- Small Seal style *xiaozhuan* (小篆),
- Official style *lishu* (隸書),
- Grass style *caoshu* (草書),
- Regular style *kaishu* (楷書),
- Running style *xingshu* (行書).

There are many variations of the above-mentioned styles and of course a few more styles which some authors consider worth mentioning in a general overview, but there is no need to go into detail about these here, since it is very unlikely that the different writing styles will have any importance when discussing writing systems for visually impaired persons. The different writing styles altered the actual forms of some characters and this at times also affected the number of strokes they consisted of. In this respect the reduction in the number of strokes of some 2000 characters in the middle of this century, known as *jiantizihua* (簡体字化), can be viewed as the most recent change in the style of writing a Chinese character.

The lexical order of the Chinese characters, when not listed according to their pronunciation, can be achieved through counting the number of strokes they consist of and standardizing certain strokes or

combinations of strokes of the characters. For example, in many modern standard dictionaries characters are related to one of 214 different basic combinations of strokes, which will be referred to as graphic components, *bushou* (部首). The graphic components are ordered according to the number of strokes they consist of and the characters under their specific listing are put into order according to the number of the remaining strokes in the character. The number of strokes a character consists of and the graphic component under which a character is ordered are therefore important features of a character.

There is a very clear indication of the changes in calligraphy and changes in writing styles through archaeological finds and ancient manuscripts, but there is only limited information about changes in the pronunciation of the characters. Such information can for example come from dictionaries for poetry. However, the pronunciation of the character was always an important and, in some respects, essential part of the character. This is most obvious in poetry, songwriting, and in the use of specifically cryptic writing. Some graphic components can even be bearers of a specific pronunciation which can be an essential part of the visual image of the character. It is in this respect, that the pronunciation of the character can be considered both part of the *Corpus* and of the *Geist* of the character. For the notation of the pronunciation of characters several systems like *zhiyin* (直音) and *fanqie* (反切) have been devised, the most recently introduced of which is *hanyu pinyin* (漢語拼音).

While the above-mentioned features comprise parts of the *Corpus* of a Chinese character, the following features will be referred to as the *Geist* of a Chinese character. The *Geist* of a Chinese character is what gives it its unique position amongst the writing systems of the world. While the symbol in an alphabet in general only bears pronunciation the Chinese character bears pronunciation, meaning and an almost infinite body of features of *Geist*.

One key part of the *Geist* of Chinese characters is their pronunciation. The pronunciation of a character is not necessarily laid down as a part of its *Corpus* but rather has to be learned individually. It is just because the pronunciation is not necessarily part of the *Corpus* that it is possible to employ the same writing system for so many and so very different Chinese dialects. Another part of the *Geist* of a Chinese character is its use in combination with other characters in word-like combinations. These combinations will henceforth be referred to as lexical compounds. To give an example: the Chinese character for car, *che* (車) combined with the Chinese character for fire, *huo* (火) in the order *huoche* (火車) in modern Chinese stands for "railway train". Just as common as the lexical compounds is the use of Chinese characters in combination with a larger number of other characters, as in idioms or in lines of poems, songs, or well known philosophical and political phrases. These will henceforth be referred to as lexical phrases. A different part of the *Geist* is the whole complex of structures which have been added to the characters rather artificially. Whether it is the numbers given to individual characters in the

Mathews' Chinese English Dictionary or the ASCII coding of Chinese characters for use on computers, these added structures form an important part of what can be known about an individual character. In the field of computer technology for example the need for computer input for Chinese characters has created a whole new world of different complex coding systems. These input codes constitute the most recently added part of the *Geist* of a character. With these added structures, there are many more components of the *Geist* of a character than there are components of the *Corpus*. A Chinese writing system for visually impaired persons which represents individual Chinese characters would also be an added structure, a new component of the *Geist* of the character.

In this work a Chinese character is considered to be the sum total of its components, the sum total of its *Corpus* and its *Geist*. The assumption is that nobody is usually aware of all connotations and components of a character. What this means in particular is, that the visual appearance, or *Corpus*, of a character - although helpful and normally part of one's knowledge of the character - is not indispensable.

1.2 The political importance and sensitivity of changes in language, written style and script in China during this century

Throughout this century China has experienced major changes in language, written style and script. The debate about these changes is still not over. The following will outline what these changes were, which major arguments were brought forward to support different viewpoints and how very politically important and sensitive this subject was and still is in Chinese society.

The literary revolution at the beginning of this century consisted of the change from classical Chinese writing, *wenyan* (文言), to modern Chinese writing, *baihua* (白話). Education and professional work in imperial China placed strong emphasis on knowledge of literature and a person's literary skills. Examinations for public office were entirely based on such knowledge. The style of writing used was chosen from ancient classical works and very strictly standardized according to tradition. For this reason it is understandable that literature was a major focus in the revolutionary effort for change at the turn of this century. This change may be deemed one of the most important ones in Chinese written style in recent history. It therefore has to be examined more closely at the beginning of this study.

Wenyan, usually called classical Chinese, can be described as an:

> abstract system of communication for the upper class, which in spoken or read aloud form would not be comprehensible and which would not reflect dialect or pronunciation of the majority of people. (Martin, 1982: 82)

The only exeptions to this are a few works which were written with strong vernacular influence. *Baihua* on the other hand is referred to as a:

> simple and direct language [writing], inspired by the spoken language, which does not use classical cliches and allusions. (Gernet, 1988: 544)

In contrast to what is understood by most to be the strongly monosyllabic *wenyan*, spoken Chinese and *baihua* are considered to consist mainly of words made up of two or more morphemes. At the end of the last century many Chinese intellectuals blamed the use of *wenyan* and the emphasis on knowledge of literature as being two of the main reasons for the backwardness of their country, which had been cruelly displayed to them as for example during the British Opium War (1839-42) and other incidents of Western intervention in the nineteenth century. In their opinion it was not only necessary to change form and vocabulary but also to develop a completely new theory of literature and bring about a change in the attitudes of the literati. One of their main intellectual leaders *Hu Shi* (胡適 1891-1962) demanded that the new literati:

> (1) Avoid the use of classical allusions;
> (2) Discard stale, time-worn literary phrases;
> (3) Discard the parallel construction of sentences;
> (4) Do not avoid using vernacular words and speech;
> (5) Follow literary grammar;
> (The above are suggestions for a revolution in literary form and style.)
> (6) Do not write that you are sick or sad when you do not feel sick or sad;
> (7) Do not imitate the writings of the ancients; what you write should reflect your own personality;
> (8) What you write should have meaning or real substance.
> (The above are suggestions for a revolution in content.)
> (Chow, 1960: 274)

Some intellectuals, like *Qian Xuantong* (錢玄同), even went so far as to demand the abolition of Chinese as such and the introduction of Esperanto as the standard language and writing (DeFrancis, 1984: 243). This of course did not happen, but an enormous change was nevertheless under way. After the original demands had been made it was the May Fourth Movement of 1919 which contributed decisively to this change and as early as 1920 the Ministry for Education adopted *baihua* as the new standard form of writing. However, it was to be decades before the intellectuals, including those who most vigorously demanded the use of *baihua*, would get used to it (Heraldova, 1974: 1288). It was not until the communists could enforce their strict policy on language, written style and script that a clear and simple Chinese writing evolved. This was needed and used for propaganda for the masses as demanded by *Mao Zedong* (毛澤東 1893-1976) in *Yan'an* (延安). In order to illustrate the importance that was given to this subject it should be pointed out, for example, that several of the key speeches given by *Mao Zedong* in *Yan'an*, such as "On the new democracy" in 1940 (Mao, 1968: 623-669) and at a conference on art and literature during a crucial stage in the Anti-Japanese and Civil War in 1942 (Mao, 1968: 804-835), highlighted the importance of a literature written in the language of the masses as a weapon in the struggle for victory. With such a policy a simple and rather uniform language and writing was forced onto the intellectuals too.

In conclusion, considering the great importance of such a step, the change from the use of *wenyan* to *baihua* in literature was made comparatively quickly. It meant that Chinese writing could now be understood when read aloud. To learn to read, write and understand, it would now be sufficient to memorize the Chinese character script rather than also having to learn many of the ancient texts. With the use of *baihua*, ordinary education could be made more easily accessible to more of the population. This was an achievement believed to be to the advantage of the vast majority of Chinese. On the other hand, even today, allusions to classical texts or obscure references are still considered to be proof of high intellectual capacity by some writers. Since *baihua* was introduced there has almost always been a trend amongst certain groups to return to more complicated forms of writing. Furthermore the writing used in some complicated texts, as for example in certain scientific texts or poetry, cannot be described as *baihua*. In such cases modern Chinese just like classical Chinese loses the above mentioned particular quality of being comprehensible when read aloud.

Those who argued against the abolition of the use of *wenyan* as the standard of writing feared a loss of cultural heritage, the loss of literary theory and the loss of the old world order, and it was exactly these aims which the reformers had in mind. The new literature was to become a vehicle for a new Chinese world order, and as such it was of course a political topic. At the turn of the century, a crucial time in Chinese history, it was one of the first issues over which conservative and progressive forces clashed. The debate about reform of literature

divided political factions and soon was to be fought over with more than words. Only a few decades later, after the first major battle over reform had been fought and won by the reformers, would it become vital for the communist rebels in the 1930s and 1940s to find a language which the peasants could understand and to base their writing, their literature, their political discussion and their propaganda entirely on this language. Once again literary reform was believed to be of major importance for social change and in this case even for the individual survival of every communist in the struggle against the Japanese and the Nationalists.

During this century three other issues of reform of language, written style and script, apart from the abolition of *wenyan* were discussed. Firstly, the need for one specific national language with a uniform pronunciation standard. Secondly, a phonetic alphabet to document this pronunciation standard. Thirdly, there was the demand for changing or abandoning the Chinese character script.

The first issue was the introduction of a national standard language. China is a multi-national country with about fifty-six ethnic groups of which fifty-three have their own language, eighteen their own writing and eleven their own script. Yet the language of the largest group, the *Han* (漢), alone is divided into about eight different major dialects. A rudimentary national language standard called *guanhua* (官話) already existed in imperial China but was not used nationally. Ramsey states:

> ... Mandarin [*guanhua*], which was based on the educated speech of the Peking capital, was by no means the standard language in late imperial times. (Ramsey, 1987: 5)

Guanhua was the language based on the educated speech of imperial Beijing. In this century's discussion some intellectuals like *Lu Xun* (魯迅 1881-1936) and *Mao Dun* (茅盾 1896-1981) opposed the need for a single national language standard. They demanded equal recognition of all dialects (Ramsey, 1987: 14) but they never formed a strong opposition to those demanding a uniform national standard language. The need for a standard language in a modern unified China was widely accepted across the political spectrum. However, the name and purpose of such a language standard became a controversial issue between the Nationalists *guomindang* (國民黨) and the Communists *gongchandang* (共產黨). In the 1930s, *Qu Qiubai* (瞿秋白 1899-1935), one of the major figures in the debate about language, written style and script, pointed out, for example, what he saw as the difference between the bourgeois "national language", *guoyu* (國語), which was introduced by the *guomindang* and the "common speech", *putonghua* (普通話), which was supposedly for the people. The basis of the two however was essentially the same. (Pickowicz, 1981: 158)

The second issue was the representation of pronunciation. The question of representation of the pronunciation of a character was not a new one. The fact that there was no fixed direct relationship of characters with sounds had always caused certain problems especially with regard to how to hand down poetry and in the compilation of dictionaries. To solve this problem certain characters were chosen and standardized to

represent certain sounds (*zhiyin*), and later to represent the initial and final sounds (*fanqie*). Examples of the use of *fanqie* can be found from as early as the *Han*-Dynasty (漢代 204 B.C. - 220 A.D.) These standardized characters were also used for the transcription of foreign words and names. Between the 1920s and 1940s there were several attempts to introduce different phonetic transcriptions including *zhuyin zimu* (注音字母), *gwoyeu romatzyh** (國語羅馬字) and *latinxua sin wenzi** (拉丁話新文字) (Milski, 1974 a: 68). *Zhuyin zimu* was an alphabet with letters of Chinese origin. *Gwoyeu romatzyh** and *latinxua sin wenzi** used instead letters of the Latin alphabet. Of course this situation raised questions of national pride and dignity and whether to bow to systems created by the nations which had degraded China so much in the preceding decades.

The third issue was whether or not to change or even to abandon Chinese character script. The need to implement a phonetic alphabet is not ultimately identical with the attempt to abolish characters. However, the question of using a latinised version of a phonetic alphabet to replace the characters was not initially but certainly very significantly raised by *Mao Zedong* himself:

> We believe Latinization is a good instrument with which to overcome illiteracy. Chinese characters are so difficult to learn that even the best system of rudimentary characters, or simplified teaching, does not equip the people with a really efficient and rich vocabulary. Sooner or later, we believe, we will have to abandon the Chinese characters altogether if we are to create a new social culture in which the masses fully participate. We are now widely using Latinization, and if we stay here for three more years the problem of illiteracy will have been largely overcome....
> Mao Zedong, Yan'an, 25th September 1939 (Snow, 1984: 485-486)

The characters, however, have not been abolished nor has illiteracy been fully overcome, yet the phoneticisation of Chinese script and the question of whether or not the characters should be abolished have become the most controversial of all linguistic arguments in this field of studies. Many linguistic works attempt to support either one or the other viewpoint. Two eminent Western experts may be quoted although the debate has been just as fierce or even fiercer amongst Chinese scholars.

> And who will seriously propose that the Chinese should undertake to translate into colloquial (and which colloquial?) — a translation, moreover, that would be entirely impracticable — his literature, which is one of the most voluminous in the world? Secondly, this marvellous tie between all the parts of the great country which is formed by its literary language, its written Esperanto, would have to be broken. ... As it is now, the Chinese possess a medium so ingenious, so supple, that the preservation of the political unity of China through the ages can be ascribed to a large extent to its unifying force.
> If China does not abandon its peculiar script in favour of our alphabetic writing, this is not due to any stupid or obdurate conservatism. The Chinese script is so wonderfully well adapted to the linguistic conditions of China that it is indispensable; the day the Chinese discard it they will surrender the very foundation of their culture. (Karlgren, 1923: 40-41)

> Karlgren's elitist defense not only of characters, but of the classical style as well, has the musty odor of defense of Latin against such a break with the European cultural past... (DeFrancis, 1984: 199)

The argument in favour of the abolition of Chinese character script was, and still is, based mainly on the assumption that Chinese character script may be the major cause of China's backwardness and the country's widespread illiteracy. The argument in favour of Chinese character script was and is based mainly on the assumption that a specific Chinese culture essentially relies on the existence of Chinese

character script. It is furthermore believed by many that Chinese character script is essential to the unity of China.

Irrespective of whether a change would be advisable or not, there is of course the additional question of whether or not such a change would be at all possible. A frequently quoted Chinese text seems to prove that this would not be the case due to the many homophones in Chinese language:

> 石室詩士施氏，嗜獅，誓食十獅．氏時時適市視獅．十時，適十獅適市．氏視十獅，恃矢誓，使十獅逝世．氏拾是十獅屍，適石室，石室濕，氏使侍拭石室，石室拭，氏始試食是十獅屍．食時，始識是獅屍，實十石獅屍，試釋是事．
> (Renmin Ribao 1.11.1990)

It is pronounced as follows:

> Shi shi shi shi shi shi, shi shi, shi shi shi shi. Shi shi shi shi shi shi shi. Shi shi, shi shi shi shi shi. Shi shi shi shi, shi shi shi, shi shi shi shi shi. Shi shi shi shi shi shi, shi shi shi, shi shi shi, shi shi shi shi shi shi, shi shi shi, shi shi shi shi shi shi shi shi. Shi shi, shi shi shi shi shi, shi shi shi shi shi, shi shi shi shi.

And it translates as follows:

> The `stone house poet' Shi Shi was fond of lions, and he swore he would eat ten lions. Mr Shi often went to the market to look for lions. At ten o'clock it happened that ten lions came to market. When Mr Shi saw the ten lions he stuck to his word and caused the ten lions to depart from this world. Mr Shi took these ten lion corpses and went to the stone house. The stone house was wet, so Mr Shi had his servant wipe the stone house. Only when the house had been wiped did Mr Shi try to eat these ten lion corpses. Only as he was eating did he realise that these lion corpses really were ten stone lion corpses. And now dear reader please try to explain this story.

Even supporters of phoneticisation of the Chinese script admit that:

> In the case of such unspeakable Chinese the Chinese characters are indeed indispensable. Only if written Chinese really conforms to the definition of spoken Chinese written in characters is it possible for the characters to be replaced by alphabetic writing. (DeFrancis, 1984: 195)

But, they argue, such conformism could be achieved and the benefits would be enormous. On the question of whether to use Chinese character script or not, emotions and arguments are numerous and compelling.

Another approach to lessen the problems with Chinese character script was the attempt to simplify it. Such suggestions had already been made in the *Qing* Dynasty (清代 1644-1911) and also under the Nationalist (*guomindang*) government. But there were no significant moves towards simplification before the Communists took power (Martin, 1982: 89).

1.3 The three main aspects of planning with regard to language, written style and script in the People's Republic of China

In the first half of this century stringent policy concerning language, written style and script was impossible due to the tumultuous national situation. After the foundation of the People's Republic of China, however, planning in all the above mentioned aspects was placed on a national scale with a high priority. Introducing measures that would reduce the very high rate of illiteracy and enable better and quicker education for the majority became a major political task in the 1950s. *Zhou Enlai* (周恩來 1898-1976) in 1958 summed up the tasks of planning measures in the People's Republic of China as follows:

> Current tasks of reforming the Chinese written language involve the simplification of the Chinese (han) characters, popularisation of the common speech (pu tung hua) and the drawing up and putting into practice of the Scheme for a Chinese Phonetic Alphabet.
> (Zhou, 1958: 7)

He demanded reform of language, written style and script. Simplification of Chinese character script meant the abolition of those Chinese characters which were hard to write, hard to recognize and hard to memorize (Martin, 1982: 270). An attempt was made to reduce, therefore, the numbers of strokes used in a Chinese character, transforming old and long Chinese characters, *fantizi* (繁体字), into new and short Chinese characters, *jiantizi* (簡体字). Additionally, there was the aim of reducing the overall number of existing characters. Regarding the simplification of characters it is now evident that sufficient research had not been carried out when the new characters were first introduced (Ramsey, 1987: 151). It can be argued that particularly with regard to this question it might have been political influence which decided the argument rather than linguistic considerations. *Wu Yuzhang* (吳玉章 1878-1966) is quoted as saying:

> In the year before last Chairman Mao told me that we should proceed with the simplification of the Chinese characters in the first place, since language reform work should not depart from reality. (Milsky, 1973: 111)

It is not clear what motivated the political pressure on this particular part of script reform, and even today it is doubtful whether the measure has been a success as regards the question of improving literacy and education. Yet it is clear that it created enormous expenditure, for example in printing houses, and for some years confusion with 'wild simplification'. Wild simplification is the use of unauthorized simplified characters, a phenomenon which still is not uncommon.

The basis chosen for the common speech (*putonghua*) was the popular language based on the Beijing pronunciation and the grammar of the northern dialect plus the grammar used in prototype modern literature (Martin, 1982: 204). This became the language standard all over China called *putonghua*. It is taught in all schools and used in all oral media apart from local programmes in local dialects. This caused many to fear the total abolition of dialects, but the Chinese government made it clear that such a move was not intended. *Zhou Enlai* made specific reference to this in 1958:

> Popularization of the common speech has as its aim the removal of the barrier of the dialects, not of prohibiting or abolishing the dialects. The answer to the question whether popularization of the common speech means to prohibit or abolish the dialects is definitely 'no!'. (Zhou, 1958: 16)

It might be argued that even if this had been the intention, the abolition of dialects would not have been successful anyway.

In the 1950s the earlier systems of phonetic alphabets were abandoned and the latinized form *hanyu pinyin* was implemented as a means of documenting the standard pronunciation. Before this implementation it was basically only the question of which form such an alphabet should take which needed to be decided. Was it to have purely Chinese characteristics like, for example, *zhuyin zimu* or was it to appear Western to make it easier for people from the West to learn? A Western system would show internationalism and would be clearly distinct from the earlier system *zhuyin fuhao* (注音符號) which is still used today in Taiwan. Again emotions and arguments were strong and many. *Mao Zedong*, for example, had previously favoured a latinization but later

had ordered research into a "*national form alphabet*". This caused a long delay in decision making and he himself was finally either overruled or accepted the latinization idea again. It is difficult, if not impossible, for the outsider to say what finally led to the implementation of *hanyu pinyin*, the latinized form.

At the beginning of the century the central question about reform of language, written style and script was whether it was to happen at all. In the 1950s it was politically decreed that it should happen and the question became one of how best to undertake the change. All aspects of efforts at reform were directly linked to the desire to improve literacy amongst the masses. Opposing measures of reform as such could therefore be regarded as opposing the masses and the government.

> They [the rightists] used this pretext [reform of script] to assail the Party and the government. But it was also true that they opposed the language reform. The simplification of the characters is a good thing which is in the interest of the people. The rightists who oppose the people would naturally oppose it.
> (Zhou 1958: 27–28)

Even without considering political implications, it is difficult to judge in advance the value of planning measures concerned with language, written style and script. When political implications have to be taken into account, the problem becomes extremely complex and linguistic arguments might even be pushed into the background. Although popular participation in the process of planning these measures was sought, the way decisions were finally made remains unknown. However, it is important to note that the determination of the government

provided for the speedy and effective introduction of these three measures.

Concerning the future of planning with regard to Chinese language, written style and script *Zhou Enlai* wrote in 1958:

> One remaining question with which we are all much concerned is the future of Chinese characters. We all agree that as a written record they have made immortal contribution to history. As to whether or not they will remain permanently unchanged, whether they will change on the basis of their original forms, or whether they will be replaced by a phonetic language – Latin letters or other phonetic scripts – we need not draw a hasty conclusion. (Zhou, 1958: 27–28)

The decision not to draw any hasty conclusions on all these matters has only once been violated with the introduction of more than 2000 simplified characters. Since the further implementation of any changes to language, written style or script would be mainly a political decision, it is hard to predict whether there will be any in the near or distant future. It can be said that at the moment there seem to be no indications of any further major changes in language or script. *Hanyu pinyin*, *putonghua* and the simplified characters are well established in the People's Republic of China and the government has not specified any intentions for new language planning measures. For whatever reasons there has been no decision yet on whether to remain with characters or to change completely to a phonetic script. The official line in the People's Republic of China is that in the distant future Chinese characters will be exchanged for a phonetic script, but such a decision is not urgent since there is a working system in place.

Recent developments, such as the economic success of Taiwan, which was achieved despite the use of Chinese character script there, make it more difficult to adhere to the assumption that a phonetic script would be essential for raising a nation's standards. Others still argue, however, that natural evolution will ultimately lead to a phonetic script. As things stand at the moment, neither argument is totally convincing.

It seems to be clear that future efforts in the planning of language, written style and script will be mostly connected with the increasing possibilities of computer technology. There are fundamental linguistic questions as to the most efficient computer input systems: which is the easiest to learn, which is the easiest to reproduce, which has the shortest input time? Will the best input system be character-based or pronunciation-based, will this remain an individual choice, or will there be a completely new possibility? There are of course great economic implications for independent development in the field of digitalised processing of writing which might fuel state efforts. Although the planning of language, written style and script is not on the political agenda in the People's Republic of China at present, should the issue be put back to public discussion it would cause just as many vigorous arguments as before. To illustrate that this issue can still cause a heated debate a recent publication on Chinese computing may be quoted. In reacting to the idea of sacrificing the ideographs for the sake of better computing the authors, who are not from the People's Republic of China, all share much the same opinion:

> The Chinese character has nine lives. Whoever tries to replace them with phonetics is destined to fail. (Huang, 1989: 54)

> One of the most severe criticisms that a Chinese can give one another [sic] is *Wang⁴ Ben³*, which literally means *forgetting his origins or ancestors*; equivalent to the English bastard. Those who insist that the Chinese language must be *Romanized*, in our opinion, are a bunch of *Wang⁴ Ben³* tortoises. If such an unfortunate event were ever forced down the throat of the Chinese, no benefits would be gained, and the only change it would cause could be to disinherit the Chinese people into a rootless and hopeless future [sic]. (Huang, 1989: 60)

> However, in our opinion, we should not computerize the Chinese language, but Chineselize [sic] the computer. Computerization of the Chinese language means subjecting the [sic] human dignity to a piece of cold blooded machinery. It will make the Chinese into a subhuman race and culture. We strongly protest this lack of respect for the pride of all Chinese. (Huang, 1989: 87)

Summing up, it can be said that in China, which has a multi ethnic society but uses a single script, changes in language, written style and script are closely connected to national and cultural identity. This is all the more so because the basis of Chinese script has remained essentially unchanged for almost 3000 years. In late *Qing* China (1644-1911) it was believed that changes in script and literary theory could even cause the collapse of the Chinese world order. The reform measures concerned with language, written style and script taken during this century must therefore be recognized as historically very significant. Changes in society manifested themselves in different attitudes towards such reform. At the beginning of the century promoting such reform efforts could ruin one's career and even endanger one's life. Only fifty years later it was opposition to these very reforms which did not conform with governmental politics. Although reform of language, written style and script certainly was not

the major cause of the social changes that followed the collapse of imperial China in this century, it has been a contributing factor. Changes in language attributes even became vital for the communist success in the countryside, so its political importance can hardly be underestimated. In the People's Republic of China planning of language, written style and script was placed on the national agenda almost immediately after its foundation and measures were taken mainly in three areas: simplification of characters, propagation of the use of *putonghua*, and introduction of *hanyu pinyin*. In order to improve literacy and education many arguments were to be considered. There were linguistic arguments such as whether with a language like Chinese the Chinese character script could or could not be exchanged for another system, but there were also many arguments connected with national pride, cultural identity and not least political power. Accordingly the criteria for final decision-making were not easily, and often not at all, identifiable. The renowned linguist Milsky succinctly sums this up:

> Pour résumer les réflexions précédentes, nous pouvons dire que, à première vue, le problème de la réforme de l'écriture semble appartenir surtout au domaine linguistique. Cependant, son origine et son développement relèvent de facteurs essentiellement sociaux et politiques, et les décisions finales concernant les méthodes et l'extension de sa réalisation dépendent presque totalement du pouvoir de l'État, pour qui les considérations linguistiques n'occupent certainement pas la première place. Malheureusement, les aspects sociaux et politiques de la réforme de la langue occupent en fait une place restreinte dans la discussion publique, et les vraies motivations des décisions prises par les autorités demeurent presque complètement cachées aux yeux des observateurs. (Milsky, 1974 b: 29)

Changes in language, written style and script in China are highly sensitive, politically very important and very hard to predict. It seems certain that the question of the future of Chinese script will remain

one of the most controversially discussed in Chinese society and amongst scholars. These assumptions must be taken into account when discussing Chinese writing systems for visually impaired persons despite the fact that so far writing systems for visually impaired persons have hardly ever appeared in these controversial discussions. If they did they were mainly refered to by those who supported the idea of a phoneticisation of Chinese writing. They referred to the currently used Chinese writing system for visually impaired persons as proof that it would be possible to achieve a change from character script to phonetic script. No evidence was found that those who opposed such a change used writing systems for visually impaired persons in order to argue their point.

1.4 Representations of Chinese characters

There is one more field which has so far only been briefly mentioned but is of great importance to this study. Chinese character script has to be represented other than in the usual written form of Chinese characters in several instances. The need or the means to represent Chinese characters other than in their written form occurs with the necessity and/or the availability of different modes of communication. These are mostly associated with for example the Chinese Telegraph code, Chinese Flag- and Light - signalling, writing systems for visually impaired persons, digitalised communication such as the Telex, and currently the most extensively discussed and certainly the most influential and far reaching aspect of communication, computerisation. Signing for persons with hearing impairment does not fully apply in

this instance since it is a substitute for language not for writing. A communication system for persons with both visual and hearing impairment which is different from a writing system for visually impaired persons may, however, be included, if it refers to language through representation of Chinese characters.

Transmitting Chinese characters raises two different issues. One is the procedures of the operator of the medium of communication, the person who writes the characters, and the other is the medium which the operator is using. In ancient China the form of Chinese characters was to some extent determined by the mediums of writing, be it the laborious carving in stone or the flowing elegance of the ink brush. This created a wide variety of forms of Chinese character calligraphy, but this variety is small compared to the variety created by the technical revolution of communication media. With this revolution came the need for coding Chinese characters and the necessity to distinguish between two kinds of code. The first kind of code is the coding used by the operator which essentially constitutes an input system for Chinese characters, the other is the technical coding for character-processing as for example in Chinese word-processing, the "internal code". The internal codes may be ignored at this point since this study is ultimately only concerned with the operator. The methods used for representing Chinese characters and the surrounding discussions were constantly influenced by technical progress as well as by political discussion. The telegraph for example became increasingly obsolete with other means of tele communication culminating in the

availability of digitalised communication. Meanwhile it was during the time of the cultural revolution that political turbulence not only effectively halted the discussion but also reversed previous initiatives. As has already been mentioned above, this discussion also included the extent to which Chinese characters could or should be made redundant through the use of computerisation. Most importantly it also included the idea that computerisation could be of great benefit in obviating the need to abandon the Chinese characters.

One of the earliest new modes of communication was the telegraph. The telegraph which came to China in the 1870s with its very limited technical possibilities still combined the operational code and the internal code. This means the operator learned and used the internal code. The operator functioned as the translator of internal code, from sender to receiver. At first, being mainly in the hands of foreign companies, transmission was presumably not in Chinese and still in coded letters of the Latin alphabet. (Ahvennainen, 1981: 60) The coding of the Chinese characters for telegraphic transmission came later. Chinese telegraphic code converts 10,000 characters into a four digit code (DeFrancis, 1989: 239). This code represents Chinese character script. In the surge towards the introduction of phonetic script a *hanyu pinyin* code for the telegraph was also introduced (Martin, 1982: 104). Such a code, however, does not represent Chinese character script, but the phonology of Chinese. Chinese Flag- and Light-signalling were also based on *hanyu pinyin* and therefore represent the phonology of Chinese. Chinese writing systems for visually impaired

persons have also been continuously based on phonetic transcription but these will be fully introduced later. The apparent discrepancy in representing language instead of script is still prevalent in problems of communication today, as when the computerisation of Chinese writing is discussed. It has to be remembered at this point that the phonology of Chinese cannot always sufficiently represent Chinese script in order to provide for a conversion from script to the phonology of Chinese and back to script. It must therefore be accepted that codes based on pronunciation, like the Flag- and Light - signalling can only be used for the transmission of language, not for the transmission of Chinese character script. If the receiver of such a message uses his knowledge and intelligence to transfer the language into Chinese character script, he can do this to some extent accurately, but will always falter when the transmission is made up of "unspeakable Chinese". Most recently the notion of artificial intelligence brought forward the idea that the phonology of Chinese could by means of artificial intelligence be translated into Chinese character script. No doubt, this is to some extent possible. It might even surpass the possibilities of the human receiver, but neither the human receiver nor artificial intelligence will ever be able to fully overcome the barrier presented by "unspeakable Chinese" expressed in Chinese character script.

Creating computer input systems for Chinese characters even without the use of artificial intelligence has become a favourite pasttime of Chinese and foreign linguists. The arguments surrounding them are

fierce and plentiful. For the purpose of this study two major approaches, however, will be identified.

One approach concentrates on codes representing the *Corpus* of the Chinese character. In such systems the Chinese character is usually analysed according to its graphic components but the graphic components used in ordering the characters for this purpose vary significantly. To work with such a system the operator either knows the full set of keys for a code or can choose from a list on the screen where characters are listed according to their graphic components.

Other systems offer input through phonetic writing. The operator keys in the pronunciation of a character and then is offered on screen all characters listed under this pronunciation. Advanced systems provide a possibitity for the user to key in the pronunciation of lexical compounds, which of course limits the numbeı of choices shown on the screen and enables the input of two characters at a time. Those systems rely on association and can in Chinese be collectively referred to as *lianxiangma* (聯想碼).

Both approaches can offer the operator a complete code per character so that when such a code is learned by heart no further choice from the screen has to be made by the operator. The code becomes a new part of the *Geist* of a Chinese character.

The field of representing Chinese character script in other means of communication has produced an equally fierce discussion as has the argument about Chinese character script in general. Some approaches have been chosen which represent Chinese characters while other approaches have in the process effectively abolished the Chinese character script. The problem is essentially centered around the fact that Chinese script is not directly related to the phonology of Chinese. Chinese writing systems for visually impaired persons are yet another field of representing Chinese characters and/or the phonology of Chinese about which there are likely to be similar discussions to the ones mentioned above.

The issue of Chinese writing systems for visually impaired persons is to be considered in all the above mentioned discussions, especially in as much as it has created and will create equally fierce arguments. However, while many of the above mentioned aspects have to be taken into consideration, the particular view of Chinese writing systems for visually impaired persons to be raised in this thesis will concentrate on the needs and rights of visually impaired persons. While previous discussions have focussed on a population using Chinese characters in an environment where using Chinese characters is the norm this study will focus on a population currently using phonetic script in such an environment.

Chapter 2 Writing systems for visually impaired persons

This chapter gives a very brief introduction to communication systems for visually impaired persons and partially sighted persons. In doing so, the writing system for visually impaired persons with which this study will be predominantly concerned will be identified and explained. A brief history of Chinese writing systems for visually impaired persons is given, concentrating on the case of the People's Republic of China for the period after 1949. This is followed by an introduction to and the comparison of the different Chinese writing systems for visually impaired persons which are currently used or under discussion. Chinese writing systems for visually impaired persons will be placed in a wider context by introducing writing systems representing Chinese character script in Japan and Korea and outlining the most recent attempts to adapt Chinese Phonetic Braille systems to computer technology.

2.1 Communication systems for visually impaired persons

The introduction to communication for visually impaired persons is divided into the issue of communication between visually impaired persons and the issue of communication between visually impaired and sighted persons. To assume such a difference is to assume that sighted persons do not master the communication systems designed for communication between visually impaired persons.

Relying on audio communication is presumably the oldest concept of communication for visually impaired persons. Except for situations

where the recipient and the sender of the communication were in audible range, assistance for the visually impaired person was required. Before a writing system for visually impaired persons was introduced visually impaired persons may have listened to words read out loud to them or dictated words to be written down by a sighted person. The introduction of tape recording in this century meant that this could be done without the presence of another person which marks a shift from assistance of a sighted person to technical assistance. Audio recorded literature "*Talking books*" became an important tool for visually impaired persons. It is also not unusual for visually impaired persons to send personal communication on audio tape, which in most languages compares well to writing. The development and widespread availability today of the telephone, which communicates beyond the natural audible range, should, of course, not be forgotten. The telephone has become an important and much appreciated tool for the communication of visually impaired persons. Recently, voice output of digitalised information has become a tool to bridge directly between the digitalised information and the visually impaired reader. For the reverse process voice input will certainly be an area of further research but problems associated with this have so far not been resolved.

For partially sighted persons the enlargement of script for sighted persons may be sufficient. Apart from actually writing or printing larger letters or characters several tools can be employed to enlarge existing small handwritten or printed letters or characters. The oldest

such tool is perhaps the magnifying glass. Users of large print or persons who could use large print when available will, however, be referred to as partially sighted in this work and large print will not be of further concern when discussing Chinese writing systems for visually impaired persons. As a general point it should be mentioned that enlargement of printed media relies very much on good quality of printing, which may be significantly aggravated by the complexity of the *Corpus* of Chinese characters. It should also be pointed out that special assistance for partially sighted persons in China is still extremely limited, to the point that it might be described as almost non-existent.

Writing systems for visually impaired persons provide a script which may be written down and read out by visually impaired persons. It is a haptically perceptible script and almost uniquely used by visually impaired persons while generally alien to sighted persons. This is due to the fact that script symbols for the sighted when printed in relief are difficult to haptically differentiate in small size. Symbols in writing systems for visually impaired persons are thus generally designed to be easily haptically distinguishable. Although today one writing system for visually impaired persons, generally referred to as "*Braille*", is commonly known there have been other developments such as the *Moon* script developed in the mid 19th century by the Kent born William L.L.D. Moon. However, since "Braille" has become the internationally predominantly agreed upon writing system for visually impaired persons, and since "*Braille*" has been the basis of Chinese writing

systems for visually impaired persons from its first introduction to the present, it is "*Braille*" which will be explained in the following.

Braille

The use of Braille as a medium of communication has been comprehensively explained by Barry Hampshire (Hampshire, 1981). Since certain terms previously used by other writers such as "Braille character" (Nolan, 1969), which refers to a Braille cell form, may in the context of this thesis be confusing, in the following a list of defined terms concerning Braille is given for reference, as these terms will be used henceforth in this thesis.

Braille:

A writing system consisting of haptically distinguishable, raised dot patterns.

Six-dot Braille:

A writing system consisting of haptically distinguishable, raised dot patterns, with six available dots.

Eight-dot Braille:

A writing system consisting of haptically distinguishable, raised dot patterns, with eight available dots.

Braille cell:

The space in which one full set of Braille dots can be placed.

Braille cell form:

Any of the different dot configurations.

Braille unit:

Any combination of Braille cells seperated from another by a space.

Braille block:

Any combination of Braille cells used as a meaningful part in a Braille unit but not separated by a space.

Braille, named after its inventor Louis Braille (1809–1852), is a writing system consisting of haptically distinguishable, raised dot patterns, also called Braille cell forms. Braille cell forms can represent symbols used in writing such as the letters of the alphabet or other graphic symbols such as those, for example, used in chemistry, music and so forth. The original Braille cell form is one Braille cell with a combination of up to six dots. The dots are numbered as shown below from, top to bottom, and from left to right.

1 ° ° 4
2 ° ° 5
3 ° ° 6

Braille provides for 63 different Braille cell forms plus a space (see figure 2.1, page 51). Braille cell forms have been used to directly represent the symbols of most alphabetic scripts for sighted persons worldwide. In the most basic English Braille alphabet, English Braille Grade 1, which uses full spelling and which does not take account of possible contractions a word is spelt as in the script for the sighted (For Braille cell forms see figure 2.2, page 52 taken from (Unesco, 1990: 77)).

Figure 2.1 **Six-dot Braille cell forms**

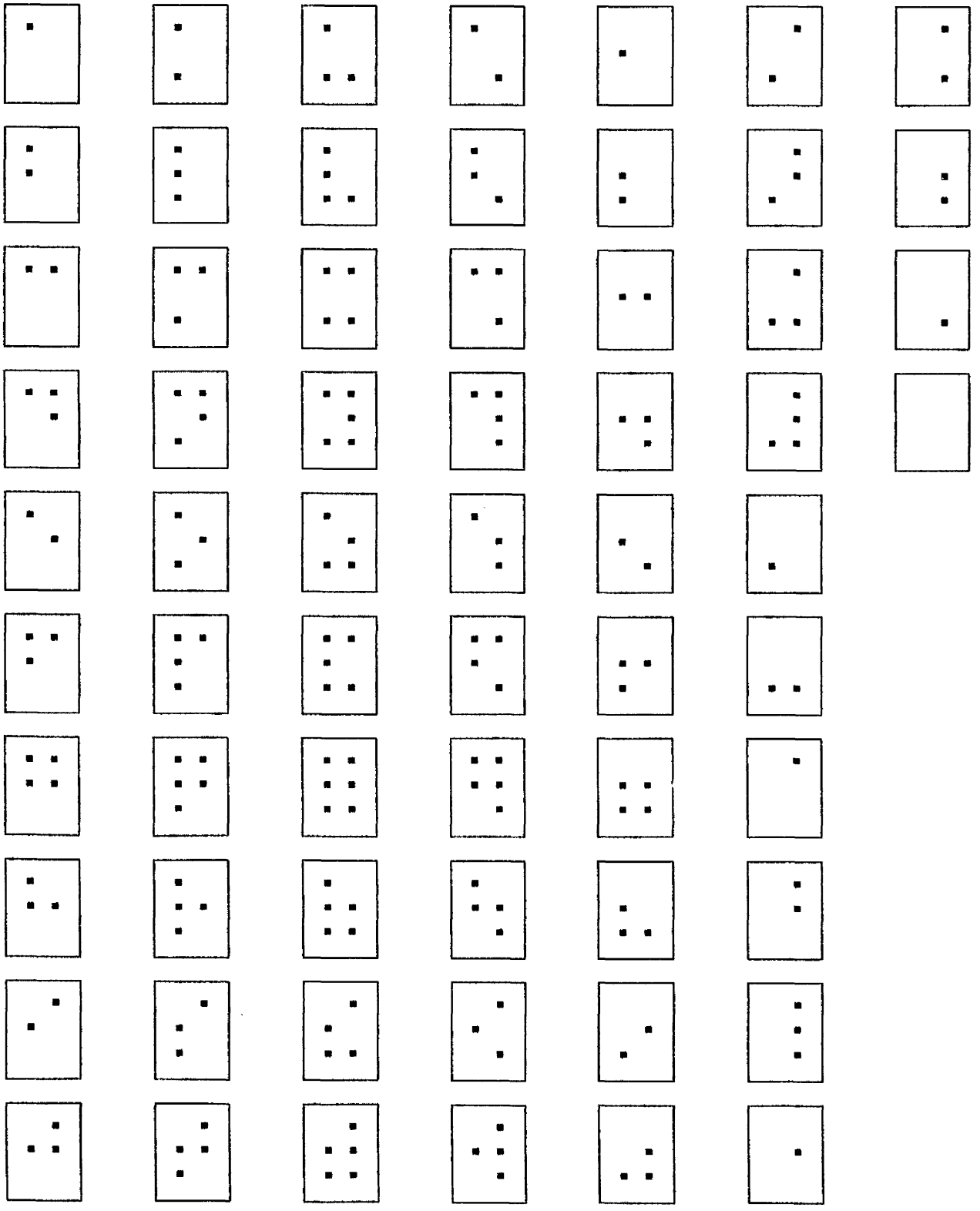
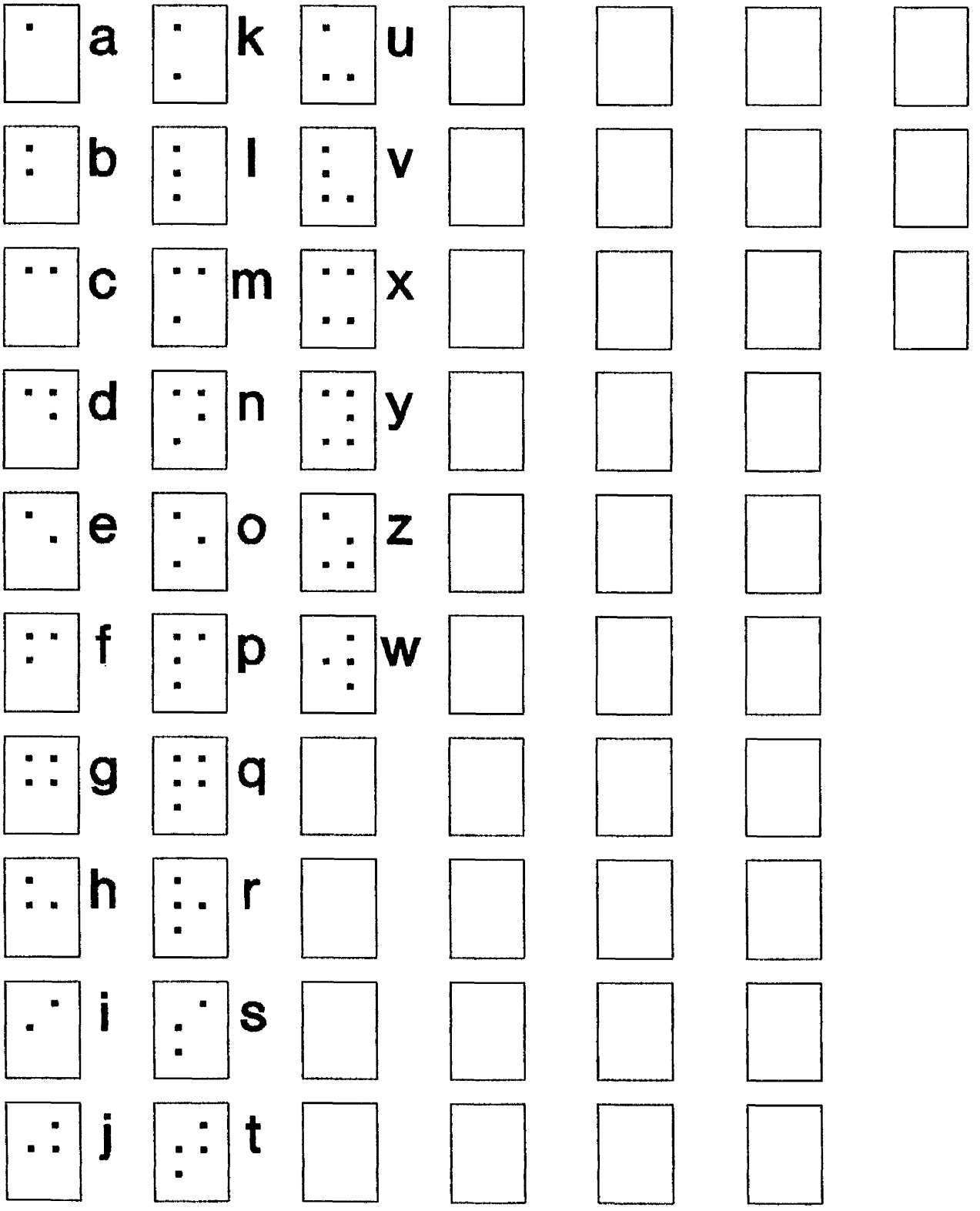


Figure 2.2 **English Braille Grade 1 - Braille cell forms**



These Braille cells would be written directly next to each other and a space would be placed before and after the word. English Braille Grade 1 is therefore functionally identical to the English alphabet for the sighted. However, Braille, even when, as English Braille Grade 1, functionally identical to the English alphabet for the sighted, provides some inherent difficulties. Not only are there the difficulties of haptically perceiving Braille script, at least at an early stage in education and especially for elderly visually impaired persons, but there is also the very personal psychological problem that using Braille entails acknowledging the visual impairment of the user. The reading rate of Braille is much slower than the reading rate of script for the sighted, which will henceforth be referred to as ink print. Output and the number of Braille printing facilities are limited compared to ink print printing facilities. Braille cells are much larger in size than ink print. To overcome problems of space in printing and speed of reading, many Braille systems have developed contractions. Braille contractions are Braille cell forms, or combinations of Braille cell forms, designed or designated to save space and reduce reading and writing time. They usually represent combinations of alphabetical letters, whole syllables or whole words. According to Nolan, who did a study on perceptual factors in Braille word recognition, English Braille Grade 2, for example, consists of the Braille cell forms for Grade 1 and 189 contractions and abreviations (Nolan, 1969: 3). The number of contractions in use varies. Individuals also often choose to use contractions for themselves for specialised terms they frequently use. The disadvantage of using Braille contractions is that they seem to reduce the readers' ability to

use context expectation. The process of reading Braille has been found to be quite different to the process of reading ink print. Contrary to earlier studies which indicated the "whole word method" (Nolan, 1969: 35) as in ink print reading, Nolan concludes that, "the perceptual unit in Braille reading is the individual braille character [braille cell form]" (Nolan, 1969: 152). Among the 63 Braille cell forms the ones with fewer dots seem to be most legible. The size and spacing of the six-dot Braille cell forms have been generally confirmed as appropriate.

Recently the use of eight-dot Braille cell forms has been added to the previous sole use of six-dot Braille cell forms. Eight-dot Braille cell forms are considered to be useful in addition to the six-dot Braille cell forms offering a wider choice of specialized symbols, especially for use in computer application.

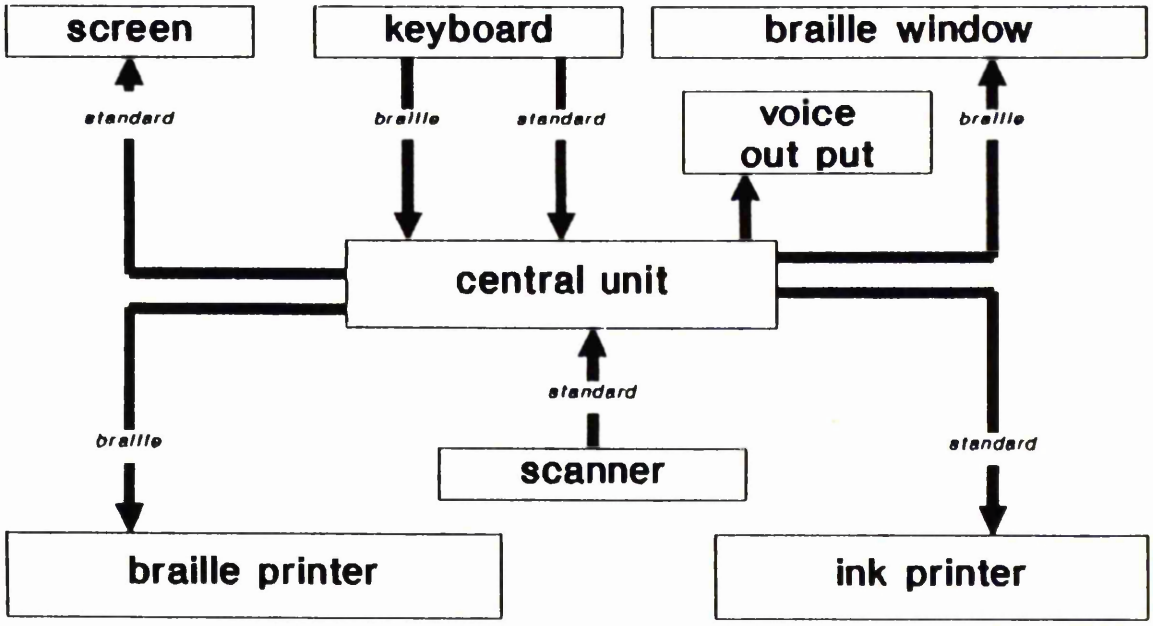
Individual Braille writing is either on plates, where each dot has to be embossed individually, or on Braille typewriters. Braille plates are frames with an embossed base in which paper is fixed, which enables the user to emboss paper with Braille cell forms in a precise way. The Braille typewriter employs chording which enables the user to emboss a full Braille cell at one stroke. The system of chording is also used in musical instruments such as the piano and machines designed for stenography. It basically provides the possibility of pressing more than one key at a time, and therefore to chord the combination of keys in one symbol or sound.

Unassisted use of Braille can only function as a communication system between visually impaired persons, when sighted persons have not mastered the system.

For communication with the sighted it was the invention of the mechanical latin alphabet typewriter which provided technical assistance for visually impaired persons to communicate with the sighted unassisted by another person. The latin alphabet typewriter is designed in a way which enables typing with closed eyes, once the position of all keys is learned. The introduction of digitalised word processing combined with the introduction of computer aided Braille output, both as hard and soft copy, has perfected this.

With regard to the reading of ink print, it was the case that until recently the direct assistance of a sighted person or the transfer of ink print into Braille by or assisted by sighted persons remained essential. The introduction of machines like the Optacon, which are basically scanners of ink print providing a haptical output, overcame this problem, although they were still quite slow to use. Now most problems can be overcome by the use of a scanner which digitalises the ink print information or by the use of digitalised information directly. On a state of the art computerised work-place for visually impaired persons this digitalised information can then be accessed either by voice output or Braille output. (See figure 2.3, page 56)

Figure 2.3 **Computer work-place visually impaired persons**



Providing for a direct representation of ink print through a writing system for visually impaired persons this means, in short, that with technical assistance, a visually impaired person can make full use of ink print media, both passively and actively. It must be pointed out, however, that the use of contractions, which constitutes a change from the direct representation of ink print script, has created several problems with the translation of Braille into ink print and vice versa.

To sum up the above description it can be said that before the introduction of technical assistance visually impaired persons had to rely mainly on the assistance of sighted persons to either actively or

passively participate in most forms of communication outside the audible range. Beginning with the development of writing systems for visually impaired persons the assistance of sighted persons began to be required less. This trend has now led to a situation where in particular by employing digitalised information for the communication of visually impaired persons, the assistance of sighted persons can be made entirely or almost entirely obsolete. This possibility, however, relies essentially on the fact that as writing systems Braille and ink print are functionally identical. As can already be seen by the use of contractions in English Braille Grade 2, the moment the systems differ even slightly, problems in the translation from one into the other begin to occur.

2.2 A short history of Chinese writing systems for visually impaired persons

Despite clear evidence that visually impaired persons have made considerable contributions throughout Chinese history, no evidence of a Chinese writing system for visually impaired persons was found before the end of the last century. Towards the end of the 19th century, about 1874, the Scottish missionary Rev. Hill Murray invented a phonetic script for the representation of the phonology of Chinese, called the Numeral Type. Murray arrived in *Beijing* (北京) in 1874 but it is unclear when he actually started working with his new system. In the Numeral Type, 408 of the 413 syllables of the Beijing dialect were simply numbered and the numbers were represented by 40 different symbols.

> According to Murray's system, instead of writing the sound, the pupil writes only the number of the sound ...
> (Gordon, 1899: 174)

Later Murray used 40 Braille cell forms to represent to visually impaired persons the 40 ink print symbols he had used for the sighted. According to available sources, this was the first Chinese writing system for visually impaired persons. It was first called the *Kangxi Symbols for the Blind*, *kangximangzi* (康熙盲字), and later the *Beijing Symbols for the Blind*, *beijingmangzi* (北京盲字) or *Harmonise Symbols for the Blind*, *xiehemangzi* (協和盲字). His system, like all those developed subsequently, was based on the phonology of Chinese, which, as has been explained above, bears no direct relation to Chinese script. Such Chinese writing systems for visually impaired persons will henceforth be referred to as Chinese Phonetic Braille. Murray's system was first developed as an alternative Chinese script for sighted persons which would make it possible for those who were illiterate to learn to read and write quickly. It can be assumed that the main driving force behind these efforts was to spread the religious Word more easily and amongst groups which might be more susceptible to this than the educated Chinese elite. Murray later considered that a version of his system for visually impaired persons would have enormous potential for spreading the evangelical message. His assumption was quite probably based on the fact that many visually impaired persons were story tellers. So, if they could go out into the country after they had learnt to read the gospel in Chinese Phonetic Braille, and <u>read</u> as visually impaired persons a completely new 'story'

to the people it would most certainly make a considerable impact on the peasants. One of Murray's students is quoted as saying:

> 'Three months ago,' he said, 'I came, though believing it to be impossible for a blind man to learn to read and write. Now praise God for His wonders to me! I can read and write anything, and instead of having to remember all as a burden on my memory, I have several books which I have written out myself. But my countrymen are all heathen, and I must go and show them what the Lord has done to me, and preach His blessed Gospel to them.' (Gordon, 1899: 77)

There are reports, however, that the impact caused by such wonder was rather too much for the peasants. They accused the missionaries of using witchcraft and threatened both the missionaries and visually impaired persons.

> [...] when the old, cruel superstition asserted itself, and the hospital was surrounded by an infuriated mob, who declared that now they had proof positive of all they had been told about foreigners bewitching Chinese men and women, and extracting their eyes to make medicine of them. It was evident, they said, that Ruth [a visually impaired Chinese woman] had been so bewitched, and that her seeing to read with the tips of her fingers was all the result of witchcraft. They would certainly have wrecked the hospital had not poor Ruth, with much difficulty, been smuggled away, and restored to Mr. Murray's safe custody in Peking. (Gordon, 1899: 53)

Whether these reports are truthful or not, other missionaries must have also quickly recognized the potential of visually impaired missionaries 'reading' the Christian message to the people, since at a 'great Missionary Conference' held in 1890 in *Shanghai* (上海) one of the subjects discussed was the potential of the various systems that had by that time already been devised for teaching visually impaired persons in China (Gordon, 1899: 139). Although today traces of these earlier systems are hard to find, knowledge of at least ten different systems which were devised soon after 1890 is available. Dates of

invention and names of inventors, however, differ quite significantly in available sources. Detailed investigation of the history was severely hampered by the fact that the archive of materials in China was reportedly destroyed during the Cultural Revolution.

In 1894 a Chinese Phonetic Braille system called *Fuzhou Symbols for the Blind*, *fuzhoumangzi* (福州盲字), for the pronunciation of *minnan hua* (閩南話), the dialect spoken by many people of *Fujian* (福建) and Taiwan, parts of *Guangdong* (廣東) and *Hainandao* (海南島), was supposedly developed by the woman missionary Ammy Jork (Xu, 1993: 14). There is question, however, as to why *minnan hua* should have been taught in *Fuzhou*, where it is not spoken. This system was based on the initial and final sounds of the syllables. For this reason some seem to consider it to be the first of the modern Chinese Phonetic Braille systems (Huang, 1985: 6). This, however, cannot be quite correct since already in 1890 in Shanghai the systems with initials and finals were supposed to be the best amongst those discussed (Gordon, 1899: 140).

In 1898 E.G. Hillier, not a missionary but the manager of the *Beijing* branch of the *Hong Kong and Shanghai Banking Corporation*, who was himself visually impaired, is reported to have also developed a Chinese Phonetic Braille system, based on *guanhua zimu* (官話字母), a phonetic script which had been developed by a scholar of the Chinese Imperial Academy, *hanlin* (翰林) (Gamble, 1921: 146).

In 1900 two English missionaries, one of whom may have been called Madam Maxi Lay, (Xu, 1993: 14) or Miss Garland (Huang, 1992:27)

created a Chinese Phonetic Braille system based on the pronunciation used in *Nanjing* (南京). The name Maxi Lay, may, however, have been reconstructed from an earlier transcription into Chinese as found elsewhere *Lai Maxi* (賴馬希) (Huang, 1985: 6). This system was called *xinmukeming mangzi* (心目可明盲字), later also referred to as *Union Mandarin Braille*. *Xinmukeming mangzi* was later applied to several other dialects including Cantonese. *Xinmukeming mangzi* was used in several specialist schools for visually impaired persons, including the *Shanghai School for the Blind*. Of course, as was usual at the time, *xinmukeming mangzi* was adjusted to the local dialect. At the *Qingdao School for the Blind xinmukeming mangzi* was even adapted to the *Beijing* dialect. Whether this replaced another system is not known. With all these different applications names given to these Braille systems also varied significantly. No lists identifying the use of Braille cells and no Braille material written in such systems was available for analysis in this study. Although around 1915 *Union Mandarin Braille* (*xinmukeming mangzi*) was supposedly agreed on as the standard system by all the specialist schools for visually impaired persons (Mackenzie, ca.1948: 63), a mixture of different Chinese Phonetic Braille systems in many different dialects continued to be used. According to the Ministry of Education in *Nanjing*, in the 1940s there were still at least four different systems reported to be in use (Mackenzie, ca.1948: 140).

Concerning the availability of printed Braille material, Mackenzie reported in 1946 that there was no central Braille Printing House in

China (Mackenzie, ca.1948: 68). Texts of the Bible were either printed abroad or were manually reproduced. Since Braille production was very much in the hands of the missionaries, it can be assumed that the majority of texts produced would have been of a religious nature. Mackenzie confirms this assumption:

> Unfortunately, with the exception of the bible and a few other books, there is still great lack of literature in Union Braille. (Mackenzie, ca.1948: 63)

After 1949, when the Communists took over power on the Mainland and the Nationalists established themselves in Taiwan (台灣) different systems remained under the different administrations in Hong Kong (香港), Taiwan and the Mainland. In Hong Kong a system based on Cantonese pronunciation has been used up until the present day. In Taiwan a system which had been developed before 1949 based on the *Beijing* dialect remains in use apparently almost unchanged since 1949. It is unclear, however, whether this system in 1949 replaced another system, possibly based on another Chinese dialect and/or Japanese Braille or whether no system at all was used at the time and before 1949 in Taiwan. On the Mainland with the commitment to and the support for one national language standard, a Chinese Phonetic Braille system was developed by *Huang Nai* (黃乃), called 'Plan for new Braille symbols', *xinmangzifang'an* (新盲字方案). This was rapidly introduced in the whole country and thus all other systems still in use were discontinued. This system combined approaches of several phoneticisation systems and Chinese Phonetic Braille systems already in existence and was at the time well ahead of the phoneticisation efforts

for the sighted in the People's Republic of China which only much later recognised similar rules.

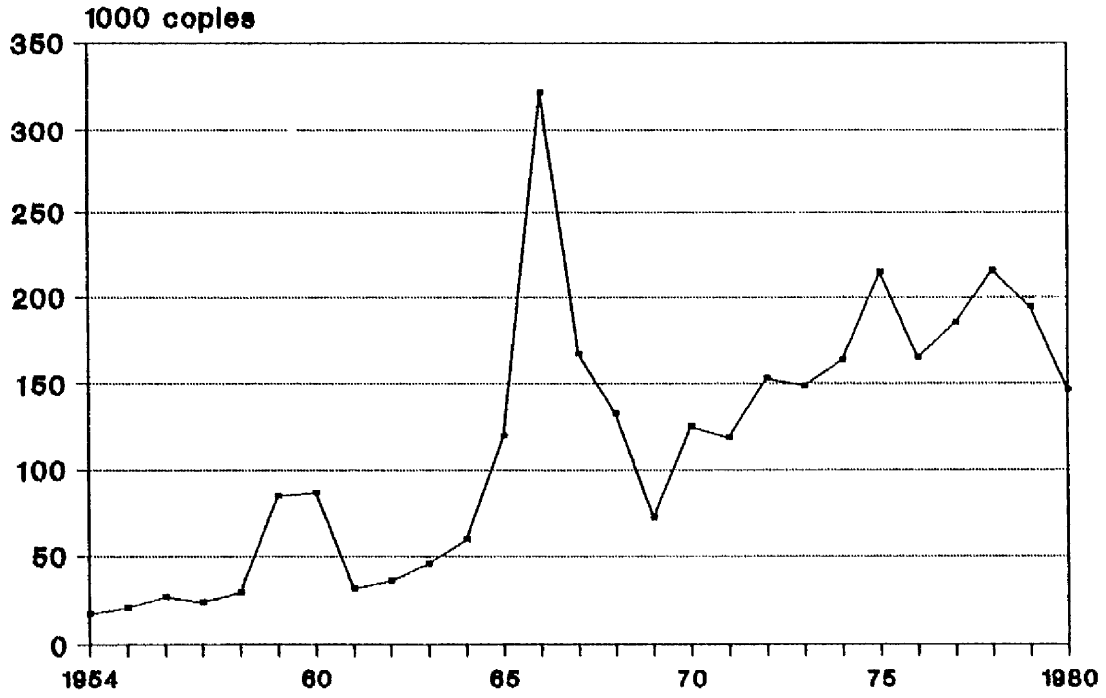
> [The 'plan for hanyu pinyin' was officially publicized already 20 year ago in 1958.] But even today [1985] no legally recognized phonetic representations have been developed. Of course there are no overall rules for the writing of words either. This is not the same for the symbols for the blind. These already master the combination of characters. On the basis of the rules for separating words in ladinghua xinwenzi, developed in the 1930s, relatively accurate rules for the writing of words were developed, creating an almost perfect phonetic writing." (Huang, 1985: 45)

The system developed by *Huang Nai* in 1953 will henceforth be referred to as *xianxing mangwen* (現行盲文). Comparable rules for *hanyu pinyin* were introduced for the sighted in 1988 (DeFrancis, 1989: 120).

In 1953 the newly established Braille Press in *Beijing* started producing and distributing *xianxing mangwen* nationwide. According to figures from the Braille Printing House, and of course not surprisingly, the works produced were no longer of a religious nature but textbooks for schools and for political, cultural and general education. By 1960 the output of Braille literature had been increased to nearly one hundred thousand copies per year. Despite disruptions caused by economic and political turmoil production rose fairly steadily, peaking in 1966 with the production of more than 250,000 copies of the works of *Mao Zedong* (see Figure 2.4, page 64). The Braille production today is sufficient, although only just, for the comparatively small readership. A small readership, since only a very small number of visually impaired children have the opportunity of going to school in the People's Republic of China, i.e. have the opportunity of learning

Braille. Estimates vary from between less than 2% to at best 10% of visually impaired children being provided with a chance to go to school (Grotz, 1992: 43).

Figure 2.4 Production of printed Braille literature between 1954 and 1980



(data taken from (Mangwen Shumu, 1982))

No material on the history of the production of printed Braille material in Taiwan and Hong Kong was available. In both areas, however, production of Braille remained at least in part in the hands of religious organisations. Today, according to users, production of the respective

Braille systems provides sufficiently for the respective readership, although never in abundance.

Summing up, it can be said that writing systems for visually impaired persons in China have been developed mainly by missionaries for the particular purpose of spreading the word of the bible. Most significant is the course of Murray's developmental work. He first sought a script which was easy to learn as an alternative to Chinese characters. He then created a tactile form of this alternative for visually impaired persons. Thus the first Chinese writing system for visually impaired persons became intentionally an alternative to Chinese character script instead of representing it and all subsequently developed systems remained so unchallenged until today. No attempt to represent the Chinese character script in China is known to the author of this study. This indicates that the need and the ability of visually impaired persons to learn Chinese character script was never acknowledged by a decision making body and also indicates a lack of concern on the part of state authority, which in the case of sighted citizens decides the script to be used but for 100 years has made no attempt to do so for visually impaired persons.

In the time between Murray's first *kangxi mangzi* and the takeover by the Communists no significant step in Braille production was taken for general education or production of essential Chinese texts. In this respect, the change in use of Chinese Phonetic Braille and Braille production after 1949 on the mainland was revolutionary. The many

different Chinese Phonetic Braille systems were all exchanged for a single unified standard one. Only four years after the Communists took power in China, it is believed that they produced Braille in China for the first time ever mechanically. But the system they implemented and still use today, like all Chinese Phonetic Braille systems developed up until then, did not attempt any representation of Chinese character script either. The disregard of the developers of the new Chinese Phonetic Braille for the representation of Chinese character script has to be seen, however, as their attempt to become the avant-garde in the general move towards phoneticisation. This was believed possible in the 1950s and is certainly the way *Huang Jiani* (黃加尼) and *Zhang Kemin* (張克敏) the authors of *Use of Dotsymbols, dianzi fuhao yongfa* (點字符號用法), understand it.

> The rules for writing words provide exemplary material for future development of a phonetic script for all nationalities. Over several decades the hanyu pinyin movement rose and fell again many times. Despite this modern Chinese Braille continued to develop. The experience gained from this can surely contribute to the phonetisation of the motherland. (Huang, 1985: 45)

Had the change from Chinese character script to a Chinese script which merely represents the phonology of Chinese taken place, then knowledge of characters would have become of very minor importance and *xianxing mangwen* would have quite probably become the model for the writing of the sighted. But this phoneticisation, of which the developers of the new Chinese Phonetic Braille sought to become the avant-garde, was not realised and is no longer on the political agenda. *Xianxing mangwen* became the avant-garde of a reform which did not take place.

In Hong Kong and Taiwan the writing systems for visually impaired persons were either introduced or remained unchanged, except for minor adjustments. Under each administration, as on the Mainland, only one system is used. There is sufficiently large production of printed materials in Braille.

Most recently a further system has entered the agenda. *Huang Nai* the inventor of *xianxing mangwen* has suggested a Chinese Phonetic Braille system very different to the one he introduced four decades ago, called *daidiao shuangpin* (帶調雙拼). This system has apparently been recently accepted by political bodies. It is suggested by government sources and the inventor that the system will be introduced in the future over an unspecified period of time.

In the following the three systems in existence plus *daidiao shuangpin* will first be explained and then compared. No governmental regulation, concerning Chinese Braille was available in either location. It is understood that, the regulations introduced here are approved or tolerated by the respective ministries of education. However, slight changes may have occurred, especially in Hong Kong.

2.3. Chinese writing systems for visually impaired persons

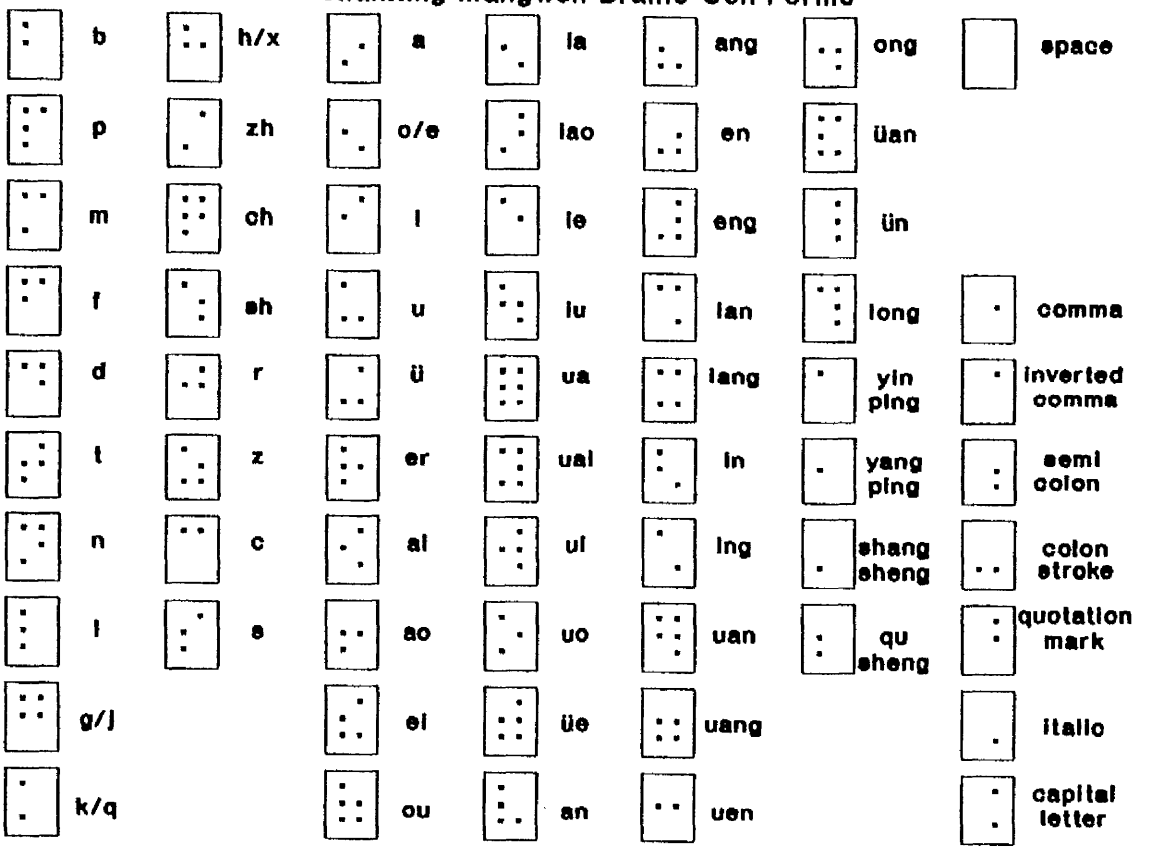
2.3.1 Chinese Phonetic Braille in the People's Republic of China

The following explanation of Chinese Phonetic Braille in the People's Republic of China (*xianxing mangwen*) is based on the book Use of Dotsymbols, *dianzi fuhao yongfa*, by *Huang Jiani* and *Zhang Kemin* published in 1985. Frequent printing errors in the Braille cells have not been noted in this text. Both authors were interviewed to confirm the information.

Xianxing mangwen uses six-dot Braille cell forms. In *xianxing mangwen* 56 of the 63 available cell forms are used for phonetic and tonal representation and the remaining 7 cell forms for orthographic and other purposes. It is a phonetic script representing the phonology of Chinese, based on the initial and final sounds of the Chinese syllables as used in *putonghua*. Any Braille cell form is used only for the representation of either an initial or a final. The system has 18 initials with the pairs of g/j; k/q and h/x each being represented by just one Braille cell form and 34 finals with o and e represented by the same Braille cell form. (see Figures 2.5, page 69)

Usually one initial and one final form one syllable as for example: b + a = ba or ch + uang = chuang. Some initials and all finals, however, can also form a syllable on their own (see List 2.5a, page 69). When initials represent a syllable on their own they will be referred to as full initials and when finals represent a syllable on their own they will be referred to as full finals.

Figure 2.5 **Xianxing Mangwen Braille Cell Forms**



List 2.5a

initial:		finals:			
zh	= zhi	a	= a	uo	= wo
ch	= chi	o	= o	ue	= yue
sh	= shi	o	= e	an	= an
r	= ri	i	= yi	ang	= ang
z	= zi	u	= wu	en	= en
c	= ci	ü	= yu	eng	= eng
s	= si	ai	= ai	ian	= yan
		ao	= ao	iang	= yang
(m	= m)	ei	= ei	in	= yin
(n	= n)	ou	= ou	ing	= ying
		ia	= ya	uan	= wan
		iao	= yao	un	= wen
		iu	= you	ong	= weng
		ua	= wa	uan	= yuan
		uai	= wai	un	= yun
		ui	= wei	iong	= yong
		uang	= wang	ie	= ye
				er	= er

With this script it is possible to represent all of the 413 syllables of the Beijing dialect in a very concise manner by one or two Braille cells per syllable. In '*dianzi fuhao yongfa*' only 406 syllables are listed, missing out on *lo, m, n, me, tei, chua, yo* for no apparent reason other than that they are extremely rare. The absence of *me* and *lo* could also be explained since they are already represented by *mo* and *le*. This leaves *yo* as the only sound which is not represented at all. For this syllable three characters are listed in the *xinhua zidian* (新華字典). Below all the 413 syllables of *putonghua* are listed although the order of the syllables is given according to the order of the Latin alphabet and therefore takes no account of the order of the Braille initials and finals (see List 2.5b, page 71).

In *xianxing mangwen* an additional Braille cell for tonal representation can be added at the end of the syllable. This is, however, supposed to be optional and only required when tonal indication appears necessary, to ensure better understanding or to ensure the correct reading of the whole Braille unit. According to one of the authors of *dianzi fuhao yongfa* only about 5% of syllables have a tonal indicator placed behind them (Huang, 1992: 27).

List 2.5b

a	ci	gang	jun	mai	pang	se	tun	zeng
ai	cong	gao	ka	man	pao	sen	tuo	zha
an	cou	ge	kai	mang	pei	seng	wa	zhai
ang	cu	gei	kan	mao	pen	sha	wai	zhan
ao	cuan	gen	kang	me	peng	shai	wan	zhang
ba	cui	geng	kao	mei	pi	shan	wang	zhao
bai	cun	gong	ke	men	pian	shang	wei	zhe
ban	cuo	gou	kei	meng	piao	shao	wen	zhei
bang	da	gu	ken	mi	pie	she	weng	zhen
bao	dai	gua	keng	mian	pin	shei	wo	zheng
bei	dan	guai	kong	miao	ping	shen	wu	zhi
ben	dang	guan	kou	mie	po	sheng	xi	zhong
beng	dao	guang	ku	min	pou	shi	xia	zhou
bi	de	gui	kua	ming	pu	shou	xian	zhu
bian	dei	gun	kuai	miu	qi	shu	xiang	zhua
biao	den	guo	kuan	mo	qia	shua	xiao	zhuai
bie	deng	ha	kuang	mou	qian	shuai	xie	zhuan
bin	di	hai	kui	mu	qiang	shuan	xin	zhuang
bing	dia	han	kun	n	qiao	shuang	xing	zhui
bo	dian	hang	kuo	na	qie	shui	xiong	zhun
bu	diao	hao	la	nai	qin	shun	xiu	zhuo
ca	die	he	lai	nan	qing	shuo	xu	zi
cai	ding	hei	lan	nang	qiong	si	xuan	zong
can	diu	hen	lang	nao	qiu	song	xue	zou
cang	dong	heng	lao	ne	qu	sou	xun	zu
cao	dou	hong	le	nei	quan	su	ya	zuan
ce	du	hou	lei	nen	que	suan	yan	zui
cen	duan	hu	leng	neng	qun	sui	yang	zun
ceng	dui	hua	li	ni	ran	sun	yao	zuo
cha	dun	huai	lia	nian	rang	suo	ye	
chai	duo	huan	lian	niang	rao	ta	yi	
chan	e	huang	liang	niao	re	tai	yin	
chang	ei	hui	liao	nie	ren	tan	ying	
chao	en	hun	lie	nin	reng	tang	yo	
che	eng	huo	lin	ning	ri	tao	yong	
chen	er	ji	ling	niu	rong	te	you	
cheng	fa	jia	liu	nong	rou	tei	yu	
chi	fan	jian	lo	nou	ru	teng	yuan	
chong	fang	jiang	long	nu	rua	ti	yue	
chou	fei	jiao	lou	nü	ruan	tian	yun	
chu	fen	jie	lu	nuan	rui	tiao	za	
chua	feng	jin	lü	nüe	run	tie	zai	
chuai	fo	jing	luan	nuo	ruo	ting	zan	
chuan	fou	jiong	lüe	o	sa	tong	zang	
chuang	fu	jiu	lun	ou	sai	tou	zao	
chui	ga	ju	luo	pa	san	tu	ze	
chun	gai	juan	m	pai	sang	tuan	zei	
chuo	gan	jue	ma	pan	sao	tui	zen	

Unlike Chinese characters, which are written next to each other without any specific semantic distinction, in a *xianxing mangwen* text, rules are applied for writing combinations of syllables, *lianxie* (聯寫). There is of course another way of interpreting this, the rules are applied in order to place spaces between the syllables, *fenxie* (分寫). Since in Chinese character writing no separation or combination of characters occurs and the grammar of Chinese character writing does not provide adequate rules for this, it has to be concluded that the rules for separation and combination applied in *xianxing mangwen* are therefore not according to character writing. It can be safely assumed that the rules for separation and combination are applied according to spoken Chinese, where such separation and combination of syllables is made in articulation.

The rules regarding the combinations of syllables are mainly to guarantee that all syllables which lexically belong to each other are combined. For example all nouns, verbs, adjectives and "subject - predicate word combination forming an attribute" are combined. The rules for separation and combination of the words are to be applied in such a manner as to guarantee the comprehensibility of the meaning. *Huang* and *Zhang* refer to this as separating and combining words according to the logic of the language. These rules are mainly applied according to how something would be articulated, i.e. read aloud. This fact is pointed out precisely in rule ten for classical Chinese:

> Classical Chinese is also written according to the way words are combined and separated when they are read aloud. (Huang, 1985: 75)

It can also be illustrated by the rule for writing of onomatopoeic words:

> Onomatopoeic words can be combined or separated according to circumstances. (Huang, 1985: 71)

What circumstances would these be other than how onomatopoeic words are articulated?

Discriminability of strings of Braille cells is also connected with the separation and combination of words. Both too many single cell Braille units and too lengthy poly-cell Braille units are considered to be uncomfortable for reading by visually impaired persons. If separation of units causes a large number of single cell units, then the combination of these is suggested and all Braille units with more than four syllables, i.e. eight Braille cells, are to be separated.

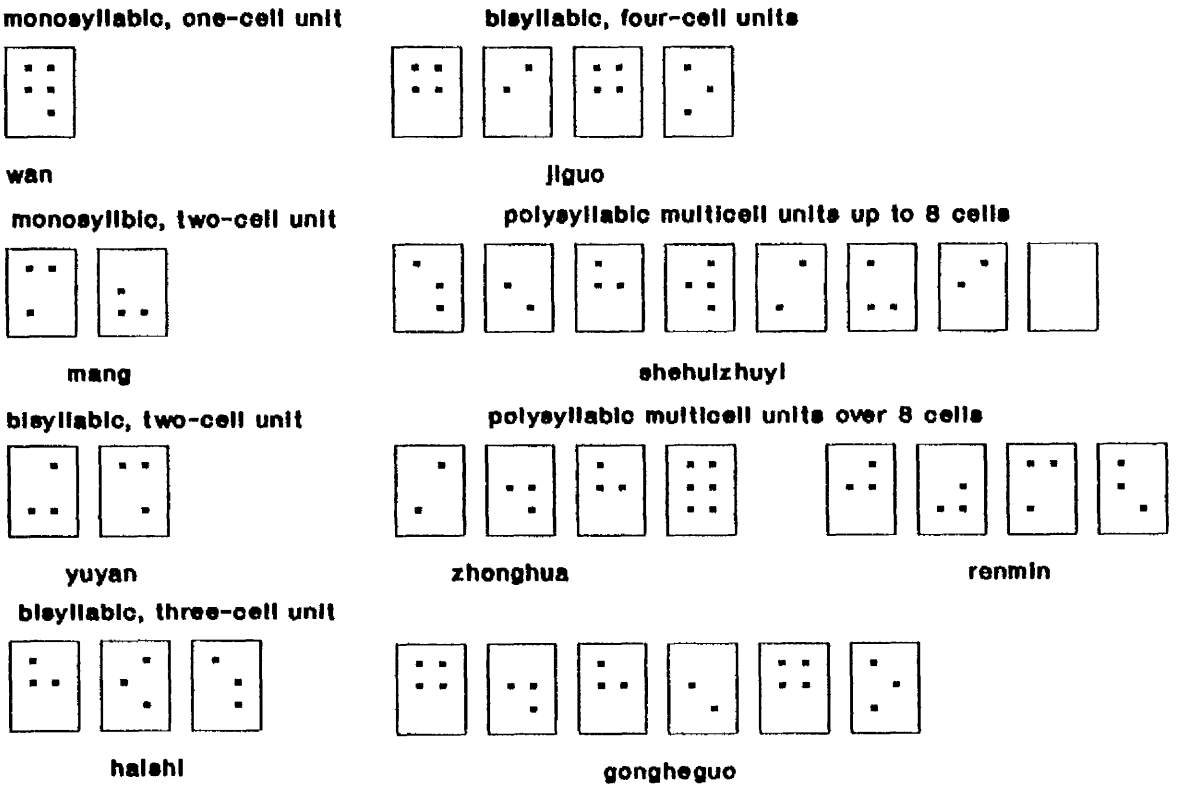
Because the rules for combination and separation lack detail and are not very strict, three overall principles are provided:

> In the last twenty odd years, in relation to the principle question of separating words, three principles in modern Chinese Braille have been put forward:
> -a- It has to reflect the structure of grammar.
> -b- It has to reflect the logic of language.
> -c- It has to be easily legible for visually impaired persons.
> (Huang, 1985: 45)

> The above-mentioned three basic rules are mutually dependent on each other and mutually related to each other, but must take as their major aspect the need to be in accordance with the logic of the language. Summed up, these aim to make the script even more precise, clearly representing the content of ideas.
> (Huang, 1985: 48)

As has been pointed out above, according to the rules for combination and separation of syllables, Braille-units up to 8 cells can be constructed (see Figure 2.6).

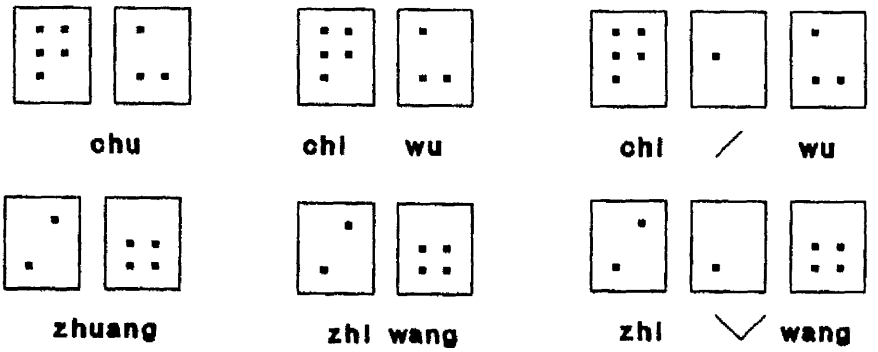
Figure 2.6 **Xianxin Mangwen Braille Units**



In most cases these units clearly indicate the pronunciation of each of its syllables. Only in cases when full initials are combined with full finals will problems arise. To give an example: *chiwu* could equal *chu* and *zhiwang* could equal *zhuang*.

In this case, when a full initial is followed by a full final, a Braille cell with the tonal representation of the first syllable will be placed between the two cells (see Figure 2.6a).

Figure 2.6a



In *xianxing mangwen* names of persons or places etc. have to be indicated by a preceding cell for capital letters. Capital letters of course do not exist in Chinese character writing. Punctuation is used in Chinese character writing to help syntactic distinction and it is to be used in *xianxing mangwen* texts accordingly.

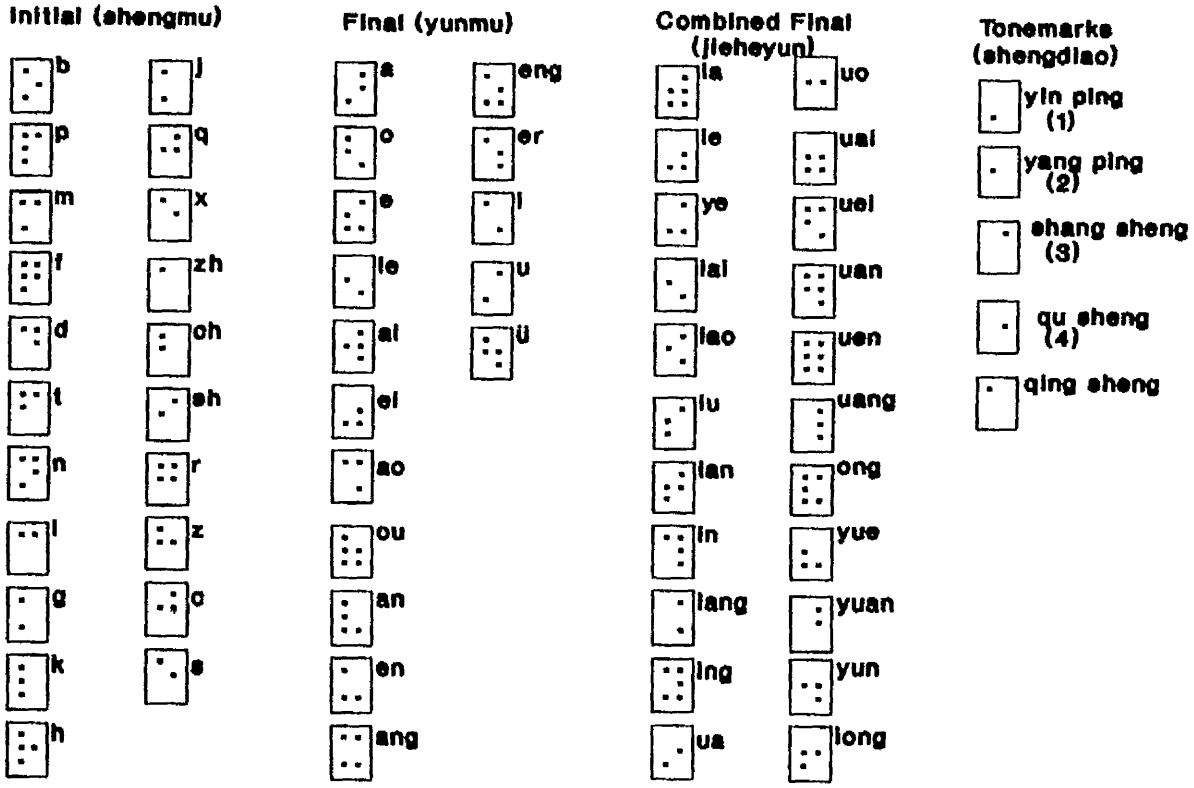
2.3.2 Chinese Phonetic Braille in Taiwan

Chinese Phonetic Braille in Taiwan will henceforth be referred to as *guoyu dianzi* (國語點字). The following explanation is based on a description provided in facsimile by *Taipei Municipal Chi Ming* School for the Blind* (台北市立啓明學校).

Guoyu dianzi uses 6 dot Braille cells. In *guoyu dianzi* all 63 available cells are used for phonetic and tonal representation and for orthographic purposes (see Figure 2.7, page 76).

Figure 2.7

Guoyu Dianzi Braille Cell Forms



Some Braille cells are used for the representation of both an initial and a final. Their function is therefore defined by their position. *Guoyu dianzi* is a phonetic script representing the phonology of Chinese, based on the initial and final sounds of the Chinese syllables as used in *putonghua*. Individual Braille cells in *guoyu dianzi* represent 21 initials, 16 finals, 22 combined finals, 5 tonal representations and 6 orthographic symbols. Some initials and finals can represent a syllable on their own, which means syllables can be represented by units of one or two cells. The tonal representation has to be added behind each

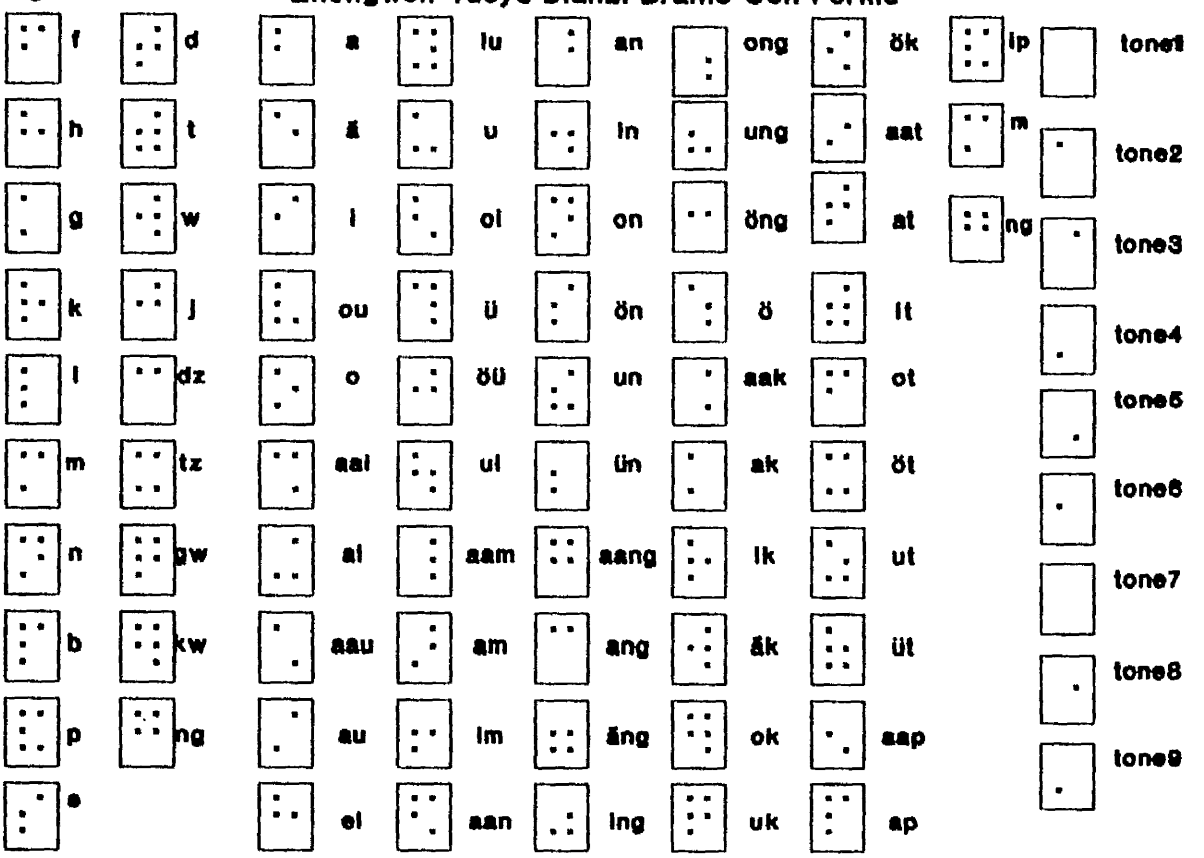
syllable. Syllables are written without spaces between them which means that they are like the Chinese characters written without any specific semantic distinction to indicate words. This also means no rules for such separation or combination have to be applied. The tonal representation behind each syllable, however, acts like a space between each syllable, in order to provide for clear identification of each syllable. A space is placed at the end of a sentence behind the full stop or the exclamation mark.

2.3.3 Chinese Phonetic Braille in Hong Kong

Chinese Phonetic Braille in Hong Kong will henceforth be referred to as *zhongwen yueyin dianzi* (中文粵音點字). The following description is based on "Zhongwen Yueyin Dianzi" (Kang, 1982) published by the *Canossa School for the Blind* in *Hong Kong*. (嘉諾撒啓明學校)

Zhongwen yueyin dianzi uses 6 dot Braille cells. In *zhongwen yueyin dianzi* all 63 available cell forms are used for phonetic and tonal representation and for orthographic purposes (see Figure 2.8, page 78). Some Braille cell forms are used for the representation of both an initial and a final. Their function is therefore defined by their position. *Zhongwen yueyin dianzi* is a phonetic script representing the phonology of Chinese, based on the initial and final sounds of the Chinese syllables as used in Cantonese. Individual Braille cell forms in *zhongwen yueyin dianzi* represent 19 initials, 53 finals, 9 tonal representations and 9 orthographic symbols.

Figure 2.8 **Zhongwen Yueyu Dianzi Braille Cell Forms**



Initials cannot individually represent syllables, finals can individually represent syllables. This means syllables can be represented in units of one cell or two cells. A tonal representation has to follow each syllable. Syllables are written without spaces between them which means that they are like the Chinese characters written without any specific semantic distinction to indicate words. This also means no rules for such separation or combination have to be applied. The tonal representation behind each syllable, however, acts like a space between each syllable, which makes the clear identification of each syllable

possible. Spaces have to be placed after syllables which are represented by a final only, without a specific tonal representation. Some further rules apply when spaces have to be placed, for example names are preceded by a special symbol and followed by a space.

2.3.4 Chinese Phonetic Braille in Singapore

According to *World Braille Usage*, which collected information from the "Singapore Association for the Blind" the languages represented in Braille in Singapore are English and Malay (Unesco, 1990: 51-65). Both Braille codes rely essentially on a Braille alphabet as in standard English Braille. The specialist school for visually impaired students in Singapore has apparently recently chosen *xianxing mangwen* for the representation of Chinese (Huang, 1992: 27). It may be expected, however, that Cantonese speaking visually impaired Chinese in Singapore and elsewhere themselves prefer to use Cantonese Braille as in Hong Kong. Equally, speakers of other dialects may prefer to use yet other systems.

2.3.5 Future Chinese Phonetic Braille in the People's Republic of China

The system which is to be introduced in the People's Republic of China in order to replace *xianxing mangwen* will be referred to as daidiao shuangpin. Although the future introduction of this system has been officially announced by *Deng Pufang* (鄧朴方), the son of *Deng Xiaoping* (鄧小平) (Deng, 1994: 6), no ink print version of the final

rules has so far been available. The publication of a book on Chinese Braille has been announced but without a definite date. The following description of the system is taken from an oral explanation of the system by the inventor *Huang Nai* in autumn 1993. It cannot safely be assumed that every detail of this description will remain unchanged before publication, as for example a first description also given by *Huang Nai* in 1991 was significantly changed. It is, however, not expected that further drastic changes will be made.

Daidiao shuangpin uses six-dot Braille cell forms in order to represent with two Braille cells the approximately 1340 or so syllables which are used in Chinese when the tonal representation is taken into consideration. *Daidiao shuangpin* use 44 initials and 45 finals. Tonal representations are included in the finals (See Figure 2.9a, page 81). By uniquely occupying 44 different six-dot configurations combined in individual cells the creation of the initials and finals can be traced back to six basic components; "full initials", "semi initials", "centre vowels", "finals", "tone marks", "empty first cell" and "empty second cell". Initials are always in the first cell and are either a "Full initial", a "Full initial" plus a "centre vowel", a "semi initial" or "empty first cell". Finials are always in the second cell and are combinations of "Final" plus a "tonal representation", "empty second cell" plus a "tonal representation" or one of the exceptions for the Final "ei" (see Figure 2.9b, page 81).

Figure 2.9a Daidiao Shuangpin Initials Braille Cell Forms

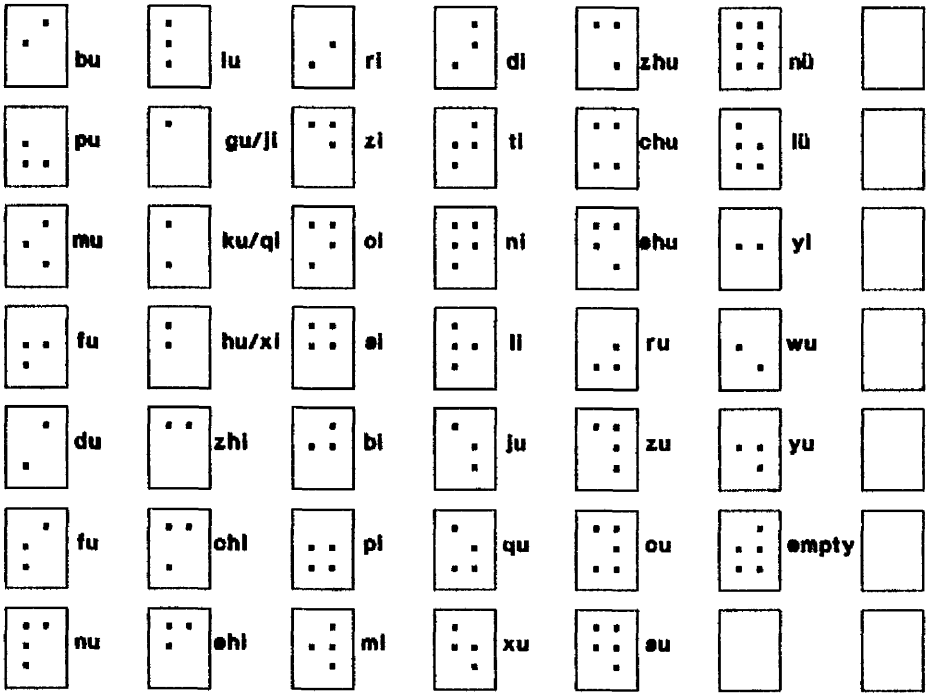


Figure 2.9b Daidiao Shuangpin Finals Braille Cell Forms

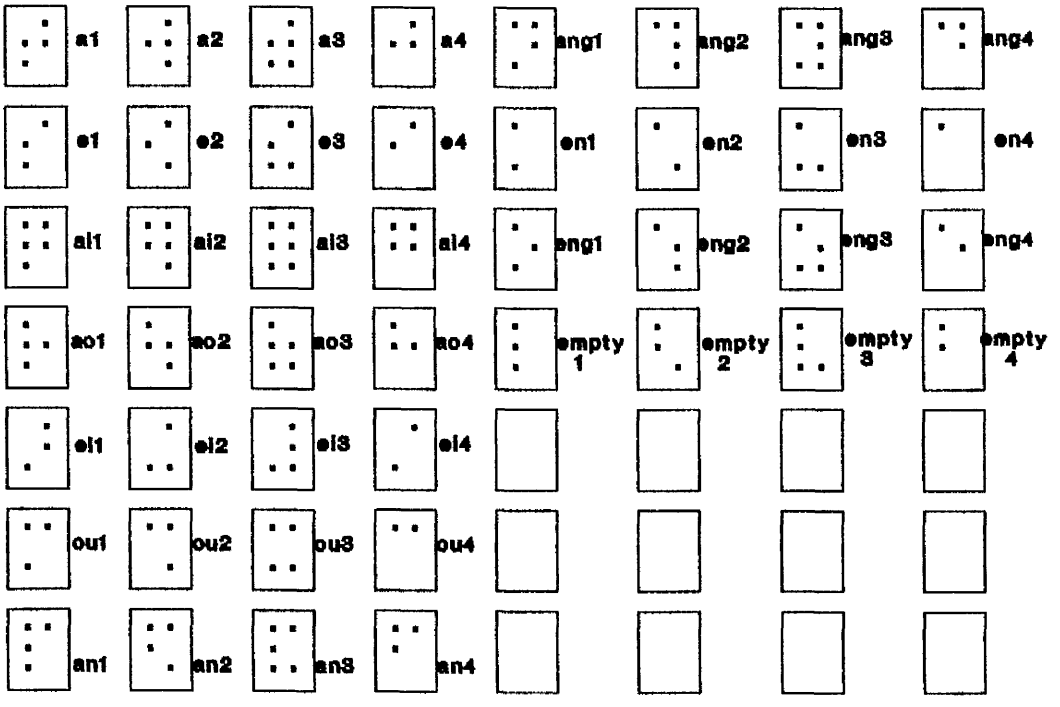
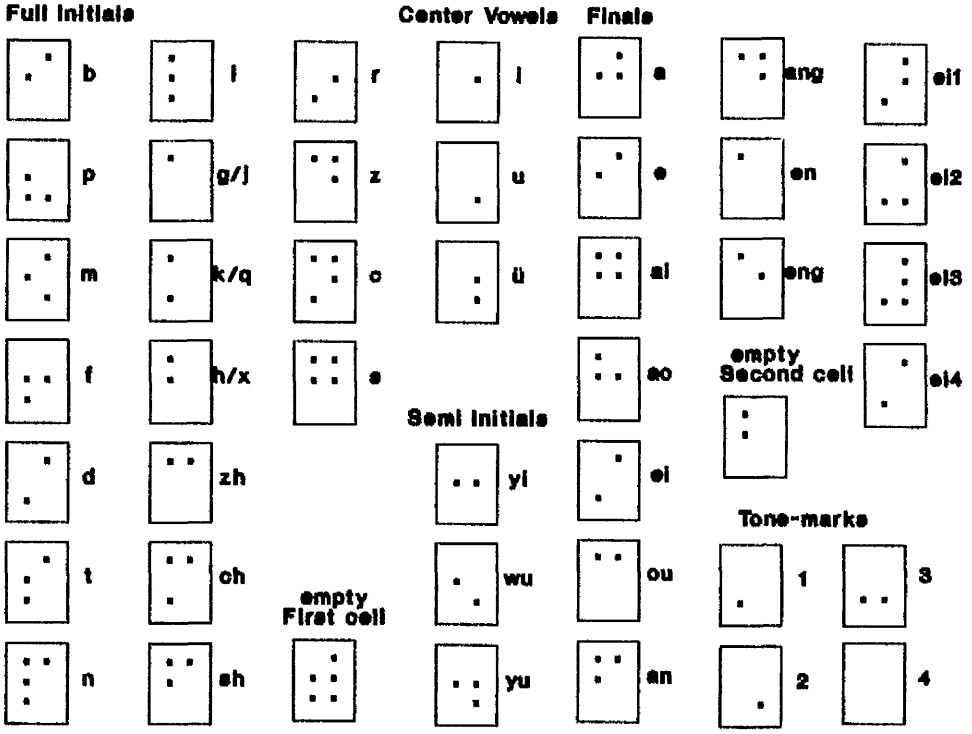
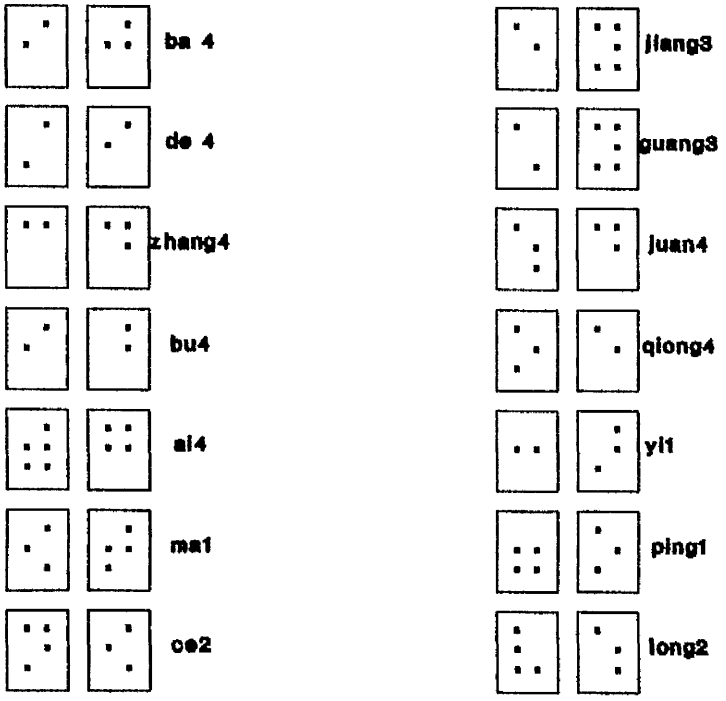


Figure 2.10 **Daidiao Shuangpin Braille Cell Form Components**



Daidiao Shuangpin Braille Units: Examples



It is assumed that the same rules for separation and combination of words as described in *xianxing mangwen* are also applied in *daidiao shuangpin*.

2.3.6 Representation of specialist scripts

Representation of specialist scripts such as music notation, symbols for arithmetic and chemistry have until recently differed in all three locations. A consultative group, the *China-Taiwan-Hong Kong Seminar on Chinese Braille* (中,港,台點字會議), with members from the People's Republic of China, the Republic of China and Hong Kong has attempted to agree on the use of such systems. They are said to have reached agreement in 1993 although no official documentation of this is available.

Scripts for the representation of Chinese characters

The above writing systems for visually impaired persons are writing systems for the representation of the phonology of Chinese and are therefore referred to as Chinese Phonetic Braille. The following are writing systems for visually impaired persons which represent Chinese character script. If such systems use Braille cells they will henceforth be referred to as Chinese Character Braille.

2.3.7 Chinese Character Braille in Japan

In Japan, a mainly phonetic writing system (*Kana*) for the sighted is used. However, in this system Chinese characters (*Kanji*) are also used. In the past the writing systems for visually impaired persons in Japan

used six-dot Braille cells to represent the phonetic writing system (*Kana*) and did not represent the Chinese characters (*Kanji*). Now two Braille systems have been developed to represent Chinese characters, one by *Taiichi Kawakami* in *Osaka* and the other by *Tadao Hasegawa* in *Tokyo*. *Tadao Hasegawa*'s system uses six-dot Braille cells and is based on the Japanese reading of the *Kanji*.

> Hasegawa uses three to four cells for his kanji. The first cell, a marker announces that the next two (or three) represent a kanji. The marker is different for the roughly seven groups into which Hasegawa classifies his kanji. Most of the groups, again, reflect the characteristic parallel readings of Kanji in Japanese - the *on* deriving from the original Chinese and the *kun* or Japanese reading. (Kalyan, 1989: 10)

His system was designed in order to provide a possibility for visually impaired persons to use *Kana* and *Kanji* together on the computer.

Taiichi Kawakami's system uses eight-dot Braille cells to represent graphic components of the Chinese characters in order to create Braille characters which he calls *Kantenji*. The graphic components can be connected either to meaning or pronunciation of the *Kanji*.

> Kantenji is, I believe, a wonderful Kanji on condition that the arrangement of dots is connected to its meaning and pronunciation. (Kawakami, 1990: 6)

In this system the first cell usually stands for the part of the character which represents its meaning and the second cell for the part of a character which represents the pronunciation, as far as they are available. Since full representation of each character would mean very long Braille units Kawakami chose what he considered the most important parts of *Kanji* and combined several graphic components under single symbols. Separation between *Kanji* and *Kana* was achieved

by attributing *Kanji* only to eight-dot Braille cell forms and *Kana* only to six-dot Braille cell forms. In this system *Kana* are written only in the lower six dots. 1900 Braille units for *Kanji* were developed.

2.3.8 Chinese Character Braille in Korea

In Korea, despite the existence of a phonetic script for the sighted (*Hangul*) and a Braille system adapted to this system, some Braille users insist on using Chinese character script.

> Korea which was long under the influence of Chinese culture cannot ignore Chinese by insisting on using Korean script alone. It is impossible to do away with Chinese terms in such fields as history, Chinese literature, or, of course Korean studies. (Cho, 1991: 4)

To ensure this, some users of Korean Braille demand a Chinese Character Braille code.

> Just as the visually impaired were also illiterate in Korean before Korean Braille was developed, they are illiterate in Chinese, as there is no Chinese [character] Braille. ... Thus the development of Chinese [character] Braille for the visually impaired is even more significant. (Cho, 1991: 4)

According to *Cho Jae Hoon*, a visually impaired teacher at the *Seoul School for the Blind*, attempts to represent Chinese character script have been undertaken at this school since the late 1970s. Since those attempts were based on Japanese representations they proved to be inapplicable. Referring to the problem that no system for the representation of Chinese characters was available *Cho* wrote in 1991: "At present, in Korea, the Problem of Hangul only usage remains." (Cho, 1991: 3) In order to change this *Cho* has developed a character Braille system which was made public in facsimile in November 1993 and

was available for this study in 1994. In his book he introduces Braille units for about 20,000 Chinese characters.

His system uses six-dot Braille cells. Two, three, four or five cells build a unit to represent one character. The graphic component of the Characters is represented in cell one and two by 55 "*selective graphic component symbols*" and 8 "*basic symbols*" creating 235 units. The number of strokes are represented in cell 3 with 50 Braille cell forms for numbers. In the fourth cell, 50 Braille cell forms for numbers are used to number characters with identical graphic component and stroke count. In case there are more than 50 characters with identical graphic component and stroke counts, cells 4 and 5 together provide for further identification by using 7 "*front symbols*" in cell 4 and 50 Braille cell forms for numbers in cell 5. *Cho* assumes that:

> "By using radical [graphic component] and stroke count in accordancd [sic] with the general dictionary, this [the code] can be in common use with the persons who don't lose his (or her) eyesight.[sic]" (Cho, 1991: 27)

This would imply that only one standard dictionary is used by the sighted, which is not the case. For example, there is a clear difference between the shortened characters (*jiantizi*) in the People's Republic of China and the long characters (*fantizi*) in Taiwan and Hong Kong, which have different stroke counts. As for not using any phonetic parts in his system *Cho* observes:

> If the radical [graphic component] is fixed in accordance with the letter of the korean alphabeth [sic] or the sound of Chinese character, in [sic] is conventent [sic] to the visually handicapped in our country. But, it was faithful to the principle of establishment of Chinese character, by considering with internationality of the cultural area of chinese writing [sic]. (Cho, 1991: 28)

It is understood that this system is now used at the *Seoul School for the Blind* to teach Chinese characters.

2.3.9 Chinese Character Braille in Hong Kong

One attempt in Hong Kong to adapt existing Chinese word processing systems for computer has resulted in the creation of a Chinese character Braille system. To give the visually impaired user of a particular computer in-put system the possibility to distinguish between different characters on screen, the system makes an eight-dot Braille version of each character's *ASCII* code available. Each code is then explained in a dictionary (conversation with *Yuan Jianming* (袁建明)).

2.3.10 Adaptations and Artificial Intelligence

In the last few years, with the rapid progress in computer technology, there have been suggestions for adapting computer input systems for Chinese character script in order to make them user friendly for visually impaired persons or to use artificial intelligence in order to act as an interpreter between Chinese Phonetic Braille and Chinese character script. These are to provide a visually impaired user with

the possibility of producing printed Chinese character script and of easily translating Chinese character script into Chinese Phonetic Braille. Some of these suggestions were presented at a conference in Hong Kong in 1993. In theory all involve either compromises which mean either that visually impaired persons have to learn a computer input system for Chinese character script which, although subsequently adapted, was developed for sighted users, or compromises which are based on the belief that artificial intelligence can act as interpreter between the phonology of Chinese and Chinese character script. Both approaches appear to assume that visually impaired persons in China will continue to use Chinese Phonetic Braille. However, some participants in this discussion, like for example Professor *Mao Yuhang* (茅于杭), have acknowledged that it is imperative for visually impaired persons in China to learn Chinese character script in order to learn to write Chinese character script on a computer. In 1992 Mao Yuhang started to teach several visually impaired students to input Chinese characters with his computer system, which was adapted for voice output, in order to enable the students to identify Chinese characters. However, no suggestion of a Chinese writing system for visually impaired persons, representing Chinese characters directly, has so far evolved from this.

Summing up the above it can be said that all Chinese writing systems currently in use or suggested for the future in China are Chinese Phonetic Braille systems which represent only the phonology of Chinese. *Xianxing mangwen* and *daidiao shuangpin* apply semantic and

syntactic rules for combining syllables and are therefore better equipped for the representation of language than those placing syllable behind syllable without any distinction. *Guoyu dianzi, zhongwen yueyin dianzi* and *daidiao shuangpin* all make it obligatory to use a Braille cell for tonal representation with each syllable. *Xianxing mangwen* leaves this optional. All systems are concise compared to a phonetic representation of Chinese with the Latin alphabet like *hanyu pinyin*.

All Chinese Character Braille systems have so far been developed outside China and are thus not necessarily applicable in China. It is quite clear that Tadao Hasegawa's system is not applicable as it is based on the Japanese reading of characters and would involve the learning of Japanese for anyone who wants to use it. Taiichi Kawakami's system which provides a feasible strategy for representing graphic components uses an eight-dot Braille system. The introduction of an eight-dot Braille system as the basis of a Chinese Character Braille would involve a major change in existing facilities, which appears impossible due to a lack of resources. In Korea *Cho* has addressed the main issues which arise from characters not being available to visually impaired persons, but the system of representation which he suggests creates at least a 100% increase in space compared to the system currently used on the mainland. In his attempt to represent the Chinese character script he uses about 120 individual meanings for 55 Braille cell forms creating over 300 internal Braille blocks to be used in units of up to 3 blocks.

In China the arguments about which writing systems are better than others have so far only been concerned with Chinese Phonetic Braille systems or representations of specialized scripts. This study will not participate in this discussion since it assumes that it will be mostly obsolete in view of the argument which is to follow. The study will also not participate in the discussion about adaptation of computer input systems for Chinese character script in order to make them user-friendly for visually impaired persons. Nor will it participate in the discussion about whether or not, or to what extent, artificial intelligence can act as an interpreter between the phonology of Chinese and Chinese character script, a discussion which centres around the same problem as the subject as to whether artificial intelligence can act as an interpreter between Chinese Phonetic Braille and Chinese character script. The thesis of this study is that there is no alternative to Chinese Character Braille.

Chapter 3 Discussion

In this chapter the terms equality, literacy and illiteracy are defined and discussed in relation to visually impaired persons in China. The implications of the Chinese Phonetic Braille systems on its users are discussed with specific reference to these terms. This is followed by a discussion of the general issue of reform of writing systems for visually impaired persons. The theoretical possibilities of representing Chinese characters for visually impaired persons are investigated in order to establish potential for reform.

Equality in society is the absence of discrimination. Discrimination involves treating a person differently, especially unfavorably, on grounds of class, sex, religion, age, and so forth.

Discrimination against visually impaired persons has been known in most societies and still exists in many. Whether forcing visually impaired women into prostitution in Imperial China (Mendoza, 1588: 113-114), or forcing highly intelligent individuals to work as unskilled manual labourers in Europe; whether it is the prejudice of employers in not employing visually impaired persons with the same abilities as required from a sighted person, or lack of assistance in negotiating traffic situations; whether it is lack of access to education or lack of available suitable media, discrimination was and is apparent in the daily life of most visually impaired persons worldwide. To overcome discrimination in all aspects of life is now a proclaimed political target of many nations. China for example has in article 1 of the legislation

regarding the protection of disabled persons, *zhonghua renmin gongheguo canjiren baozhangfa* (中華人民共和國殘疾人保障法), set itself the legal target to "...secure equal and full participation [of disabled persons, visually impaired persons included] in social life." (*Zhonghua Renmingongheguo Canjiren Baozhangfa*, 1991: 2) Since practices within Chinese society today are still highly discriminatory against visually impaired persons a long and difficult process of change has to be undertaken to achieve such a high target. The social perception of visually impaired persons as "disabled and useless", *canfei* (殘廢), has to change. Education, employment, material assistance and so forth have to be provided to all visually impaired persons whether they live in the cities or far away in remote countryside areas. The abolition of discrimination, i.e. the equal participation of visually impaired persons in society, requires changes in many fields, but this work will concentrate on one aspect only, the literacy of visually impaired persons in China.

Literacy is the quality or state of being literate, of being able to read and write, of being educated and cultured. Literacy is one of the basic Human Rights as declared by the United Nations.

> The right to learn is:
> - the right to read and write;
> - the right to question and analyze;
> - the right to imagine and create;
> - the right to read one's own world and to write history;
> - the right to have access to educational resources;
> - the right to develop individual and collective skills...
>
> .... It is a fundamental human right whose legitimacy is universal...
>
> [Those are] Extracts from the "Declaration of the Fourth International Conference on Adult Education, Paris, organised by UNESCO 19-29 March 1985 (Hamadache, 1990: 3)

To deprive a person of literacy is therefore according to United Nations conventions a violation of human rights.

Literacy is not a stable, universally defined concept. Literacy was defined quite differently at different times, and for a long time the definition of literacy was in the hands and minds of those holding power. The ability to define literacy was, and to some extent is, a means of perpetuating this power, a means of oppression or discrimination. According to today's definition different levels of literacy exist in every society whether it is the United States of America, the United Kingdom or the People's Republic of China. Some people master an easy script or parts of a script and can, for example, read and write their name and a few words and have therefore probably reached the most basic level of literacy. A few people may master most possibilities of writing but are still not fully literate since there is no limit to the extent of literacy. Levels of literacy can furthermore be seen in the following different aspects; level of reading, level of writing, level of education. The processes of reading

and writing are very different. An individual might have attained quite different levels for his/her reading and his/her writing. Reading is the process mostly regarded as engaging in comprehending and constructing meaning through interaction with text but can also be the process of repeating aloud what is written down without any comprehension. Writing can be recording of speech according to given standards or can be the creative process of expressing oneself. It is obvious that according to these definitions almost every individual has his or her individual level of literacy. The level of literacy available to individuals depends on their own ability but also, and far more importantly, on the availability of education and access to it. It is therefore largely dependent upon the economic environment, power structures in society, on sex, race, place of birth, class, and many more factors contributing to the social position of the individual and, very importantly for the following discussion, on sight.

In China, for example, over 90% of sighted children have access to education, but only about 2% - 3% of visually impaired children have this opportunity. About 80% of the Chinese population are considered to possess a certain level of literacy (Wang, 1990: 2), but the same can be said for only less than 20% of visually impaired persons in China (Renmin Ribao, 20.05.1994). Chinese policy on literacy places strong emphasis on the plan to abolish illiteracy nationally by the year 2000. It acknowledges that sex and age are major contributors to disadvantage in achieving literacy, but it does not suggest a literacy target for visually impaired persons nor does it acknowledge that

visual impairment is a major factor contributing to the disadvantage in achieving literacy.

The definition of illiteracy necessarily depends on the level of literacy which one uses to define it. It can simply mean not being able to read and write. But not being able to read and write what? Illiteracy can be "having little or no education; showing or marked by a lack of familiarity with language and literature; violating approved patterns of speaking and writing; showing or marked by a lack of acquaintance with the fundamentals of a particular field of knowledge." (Longmans Dictionary of the English Language, 1991) Not only is the author of this study an illiterate when it comes to reading theories on quantum-physics but even Shakespeare would have a difficult time in a primary school today, when asked to read and explain the manual for the newest "Gameboy".

The above-mentioned definitions of literacy and illiteracy are concerned with the very subjective and changeable aspects of social environment and conventions of writing systems. The following will discuss the effects on these definitions which are caused by the often unchanging situation when an individual has a visual impairment and therefore no access to visual media.

According to the above-mentioned conventions a visually impaired person has to be considered illiterate in respect of visual writing if unaided. A person with visual impairment cannot if unaided read visual

media and if unaided cannot usually write conventional writing for the sighted. To become literate visually impaired persons need to gain access to the medium. This they have achieved in most languages through the development of artificial aides as described in chapter two, since a writing system for visually impaired persons functionally equals a writing system for the sighted.

In all but a very few cases the writing system for visually impaired persons functionally equals that of the sighted. Most writing can be adequately represented by speech and can therefore be orally transmitted. Although the processes of learning and cognition may not be completely identical using visual media or tactile media or voice-output, and although psychological effects have to be taken into consideration, in languages where the writing system for the sighted functionally equals the writing system for visually impaired persons, literacy can be achieved by either of those means. Visually impaired persons can therefore, when provided with the same level of access to media and education, achieve the same level of literacy as their sighted compatriots.

This access is often denied to visually impaired persons because not enough Braille literature is produced, because direct reading from person to person and talking books are not available, and because typewriters or word-processors are not provided. This is especially the case with regard to mainstream education where the financial costs involved are often avoided by governments and those channelling

available resources. Denying visually impaired persons access to literacy is often due to the influence of the economic environment, but equally often it is a reflection of the ignorance of the sighted. It is a violation of human rights and constitutes discrimination against visually impaired persons.

In China, however, as will be shown below, not only are there not enough resources, but, and this is the basis for the main thesis of this study, Chinese character script and Chinese Phonetic Braille are functionally not equal.

In Chinese, literacy is *'shizi'* (識字) – to know Chinese characters–, and illiteracy is 'wenmang' (文盲) – being blind towards literature. In China not knowing Chinese character script, not to "*shizi*", therefore means illiteracy, it means that the individual is "*wenmang*". The negative effects of not knowing Chinese characters are aggravated by the fact that traditionally knowledge of literature almost equals knowledge of culture. The Chinese Phonetic Braille, despite the fact that it represents the phonology of Chinese comparable to *hanyu pinyin* does not represent Chinese character script. Learning Chinese Phonetic Braille does not therefore equal learning Chinese character script and therefore creates Chinese character illiteracy if used as the sole means of reading and writing. Chinese character illiteracy is the state of not knowing, and not being able to read or write Chinese character script. It includes the inability to understand the different connotations of Chinese characters in different circumstances and especially the inability to understand idiomatic combinations of

characters which rely essentially on the knowledge of these connotations.

Chinese Phonetic Braille cannot provide visually impaired persons with the level of literacy which their sighted compatriots can achieve, because it cannot provide them with the knowledge of Chinese character script even if the technical assistance mentioned above were available. It makes visually impaired persons phonetically literate but leaves them character illiterate.

It has been argued by some visually impaired persons in China that being able to read and write an equivalent to spoken Chinese is sufficient, and that this is an acceptable situation particularly since Chinese Phonetic Braille is so much more convenient to learn than Chinese characters script. Why should visually impaired persons go through the painful process of learning thousands of Chinese characters when modern Chinese writing is so close to the phonology of modern Chinese and when there are efforts to make it even closer? Many have argued that phoneticisation as such would be even better than the use of Chinese character script for everybody, both sighted and visually impaired persons.

But the question arising from the use of Chinese Phonetic Braille is not whether phonetic writing is better or worse than Chinese character script. There is no doubt that in China today knowledge of characters is of major importance for personal and professional purposes.

Knowledge of characters is essential for 'literacy' with the full impact of its proper meaning throughout the whole of Chinese society. As long as the sighted use Chinese character script, the fact that visually impaired persons in China do not know these characters and have no means of writing or reading them is a major factor contributing to their marginalisation. Not having knowledge and access to the writing system of the sighted acts as a barrier to general and higher education, more skilled jobs and specialized work. This problem cannot be completely overcome by visually impaired persons using Chinese Phonetic Braille. If visually impaired persons in China cannot write a letter to sighted Chinese, except in instances when they use inadequate substitutes like *hanyu pinyin*, how could they work independently in an office which deals with a sighted clientele? How could a visually impaired student of medicine learn all the necessary terminology which to a certain extent consists of unspeakable Chinese and therefore is only fully understandable with full knowledge of Chinese character script? Even if the specific terminology contained only a very small percentage of unspeakable Chinese, a visually impaired doctor of medicine could not risk writing the wrong medication on a prescription.

So far this has been an entirely theoretical argument on which, however, the second thesis of this study is based. The discussion must result in the assumption that visually impaired persons who have not received education while they were still sighted have no knowledge of Chinese character script whatsoever. One might have presumed that referring to characters by referring to commonly used lexical

compounds would make it possible for visually impaired persons to distinguish individual Chinese characters. However, initial attempts at the *School for the Blind* in *Beijing* to make visually impaired students write Chinese character script using computer input systems have shown that visually impaired persons cannot identify Chinese characters (Mao, 1993: 9–10). They have no access to the wide spectrum represented by individual characters in their form, their semantic parts, their history, their meanings and the like. Neither *Corpus* nor *Geist* of a Chinese character make sense to visually impaired users since they only make sense to those who can identify a Chinese character and have gained additional knowledge about this character through learning. Visually impaired persons in China have not yet had the chance to acquire this kind of knowledge. There is no teaching of character script. There is only teaching of Chinese Phonetic Braille for visually impaired persons.

There is a further significant effect of the difference between Chinese Phonetic Braille and writing in Chinese character script. Chinese Phonetic Braille based on *putonghua* pronunciation is not as universally applicable as the characters are. This is due to the many different dialects in the country. A visually impaired child from *Sichuan* Province (四川) or *Shanghai* must first learn *putonghua*, before he or she can start to learn Chinese Phonetic Braille.

The government of the People's Republic of China aims to provide equal opportunities for disabled persons in society, for example with the *zhonghua renmin gongheguo canjirenbaozhangfa*, yet Chinese Phonetic Braille is a major source of inequality. In this respect equality for visually impaired persons means that no alternative to the knowledge of Chinese characters can be entirely satisfactory to visually impaired persons as long as Chinese character script is employed as the writing system for the sighted. Providing only disadvantageous systems for visually impaired persons discriminates against visually impaired persons to an extent which constitutes a violation of human rights according to United Nations conventions. The state has apparently let issues of Chinese writing systems for visually impaired persons be self-regulated by bodies concerned with the education of visually impaired persons and the production of printed material. Self regulation, however, has failed in this particular respect. It is clear, that only with a writing system for visually impaired persons which represents Chinese character script, will it be possible for visually impaired persons to read and write Chinese character script. Only with such a system will they be able to question and analyse Chinese character script, will they be able to imagine and create Chinese character script, will they be able to read their own world and write history in Chinese character script. Only with such a system will they have access to educational resources and will they be able to fully develop their individual and collective skills.

It has been explained in chapter two that there are a variety of aspects of communication of visually impaired persons. The peculiarities of Chinese language, written style and script give rise to a number of problems which have not been identified in the above description. For example the relationship between the phonology of Chinese and Chinese script and also the differences in regional dialects, create problems for any system based on verbal communication. Also the scanning of Chinese character script still requires improvement but in any case is also ineffective as long as the gap between Chinese character script and Chinese Phonetic Braille remains. These problems will not be further investigated here.

In the following the general issue of reform of writing systems for visually impaired persons and the theoretical possibilities of representing Chinese characters for visually impaired persons will be discussed in order to establish the potential for reform.

It has been pointed out in chapter one that reform of language, written style and script in China has always been a very controversial and political issue. Since reform of Chinese writing systems for visually impaired persons is a reform of script, it has a dimension far beyond that of pure academic considerations of the length and readability of the Braille units. This is especially so, since a change as outlined in this study constitutes a complete reversal of the trend in the sixties, when the official line was to go from Chinese character script towards a phonetic script. The use of Chinese characters as script is still not universally agreed upon in China and abroad, and many have sought

alternatives which were also very controversial. To discuss a form of Chinese characters which are readable for visually impaired persons in order to replace or widen a phonetic script used exclusively by visually impaired persons, will ultimately raise questions about the nature of Chinese character script. It will raise questions about the use of Chinese characters as a writing system for visually impaired persons and sighted alike. Although this work does not suggest changing the character script for the sighted it is likely that the discussion about Chinese Phonetic Braille will be drawn into this general debate. The discussion about the reform of Chinese Phonetic Braille, and the debate about Chinese writing in general, cannot be separated. It becomes evident that beyond academic considerations reform of writing systems for visually impaired persons is a political issue. However, having concluded that Chinese Character Braille is essential in order to fulfil the basic requirements for literacy of visually impaired persons in China, this political dimension will not be discussed any further. In the following the question as to whether and how Chinese characters could be represented for the use of visually impaired persons will be analysed.

A Chinese writing system for visually impaired persons which fulfils the requirements for literacy of visually impaired persons equal to that of sighted persons has to enable visually impaired persons to work with Chinese character script fully both in reading and writing. It has to enable the visually impaired user to identify each individual character.

A short series of tests, as well as experience in the production of relief tactile material (Lehmann, 1990) make it clear that the possibility of haptically representing Chinese character script in its original form must be dismissed for one simple reason. The sheer size of such characters needed for proper haptical perception and recognition would be out of the question for everyday use. The complexity of lines in Chinese characters requires so much space between these lines that less than 10 characters per page would be feasible. It is suggested that raised characters may be used in the education of visually impaired persons in order to further the understanding of students of the appearance of the *Corpus* of the characters but relief characters cannot feasibly become the medium of the required reform.

It is therefore essential to apply a wider view of the Chinese characters, a view which permits the understanding of the code of a Chinese character as a Chinese character. This view accepts that being able to identify an individual character equals knowing a character. Assuming a Chinese character can be coded for visually impaired persons, it is possible, in principle, for those without vision to learn the character.

Six-dot Braille cell forms are the most widely used writing system of visually impaired persons used for representation of writing systems for the sighted. They are also used in all areas where Chinese writing systems for visually impaired persons are employed. Eight-dot Braille

cell forms have been taken into consideration for this study but have proved not to be more space effective than six-dot Braille cells. They may be taken into account, however, in order to fulfill special requirements of Chinese characters or once the initial stage of coding Chinese characters is completed and contractions, shorthand-systems, or sets of special symbols, are considered. At this point, however, only the use of six-dot Braille cell forms for the representation of the Chinese character script will be subject to analysis.

It is, in fact, quite simple to show that representation of characters with six-dot Braille cell forms is theoretically and practically possible. Only two factors have to be taken into account:

1.) Each Chinese character has to be represented individually by one unique Braille unit. Since 74,000 different characters is one of the highest numbers quoted, this may be taken to be the number to be achieved by any system.

2.) The representation has to be with units made up of six-dot Braille cell forms.

Simple multiplication shows that the use of 3 Braille cells with 42 Braille cell forms per unit would guarantee the number of Braille units needed, already providing for 74,088. With all the 63 Braille cell forms, six-dot Braille units of three cells would provide codes in abundance.

The essential question is therefore not whether the representation is possible but, how the representation of Chinese characters for visually impaired persons will be most feasible.

There is no evidence yet about what kind of system for the coding of Chinese character script would be preferable for visually impaired persons in China or which of the many components of the characters could be most conveniently learned by visually impaired persons. A main question is of course whether it makes any sense to represent any components of the character, or whether an entirely new idea should be developed. Investigation is needed into whether the *Geist* of the character should gain an entirely new component designed exclusively for the needs of visually impaired persons or whether existing parts of the *Geist* or the *Corpus* can be coded for visually impaired persons.

There are an infinite number of possibilities for the representation of Chinese characters in a non-visual way. Using six-dot Braille cells such representation can be purpose-designed with a wide range of possible applications. Assuming that more than three Braille cells are used all possible character components can be taken into consideration. There are reasonable alternatives which make the incorporation of any high or small number of components possible. The systems in Japan, Korea and Hong Kong are already proof of this. In theory also any of the computer input systems for Chinese script could be translated into a Braille code.

However, once all individual characters are coded for visually impaired persons, such a writing system can be employed in order to produce ink print Chinese characters. The application of any Chinese Character

Braille system as computer input systems for Chinese characters presents no problem. With existing hardware visually impaired persons can easily create ink print output i.e. write Chinese characters for the sighted.

The specific characteristics of Chinese character script make it essential that, for visually impaired users of a writing system which equals Chinese character script, all tools which are available for users of Chinese character script are to be made available to them too. When a basic system where every single character in existence is represented by a unique Braille unit has been developed and has been agreed upon nationally, lexica and encyclopedia have to be produced.

For visually impaired persons, as for the sighted, it will not be necessary to be aware of all that is incorporated in a character as described above and especially not of all of the visual appearance of a character. However, it might be desirable to achieve a close connection between what the sighted know of characters and what visually impaired persons will know of characters. It is necessary to investigate the knowledge of Chinese character script held by visually impaired persons and methods of cognitive learning of Chinese Characters by visually impaired persons. Once this knowledge is identified and methods of cognitive learning are suggested by visually impaired persons, the results can easily be applied as shown above and their usefulness or their overall size established.

The questions of whether this reform is theoretically possible and which components of the Braille unit would prove easiest or most successful are not the only questions which need addressing. The reform can only be possible if it is made by visually impaired persons in China, if they can accept such a tool at present, if reform efforts are supported by the authorities, and so on. Since the perception of the problem of reform of Chinese Phonetic Braille can be strongly influenced by personal experience, it will be essential to establish the extent of personal experience visually impaired persons in China have with regard to Chinese characters. It will also be necessary to consider how new experiences with Chinese characters, such as in teaching, could be sensibly achieved. This includes especially the personal attitude towards the prospect of becoming a user of Chinese character script. It will furthermore be necessary to gather information particularly on two aspects. Firstly, which systems would be preferable to visually impaired persons, even and especially if these are not theoretically the most efficient systems. Secondly, what attitude towards reform of Chinese Phonetic Braille is found amongst those in decision-making positions and which systems would be preferable to them.

It has been argued that reform of Chinese Phonetic Braille in favour of Chinese Character Braille is necessary, that it is possible to implement it in various different ways, and it has been pointed out that reform of Chinese Phonetic Braille will be a very sensitive subject. Since no data whatsoever were available, even on the most fundamental

questions raised above, it became necessary to produce data in order to provide for a reasonable discussion about future reform efforts. The data to be produced had to include in particular the knowledge and the attitude of the people concerned, visually impaired persons in China. For this reason it was necessary to investigate the perceptions of Chinese character script and its representation for visually impaired persons by users of writing systems for visually impaired persons in China.

Chapter 4 Field-research

This chapter presents the results of field research undertaken in China to investigate the perceptions of Chinese character script and its representation for visually impaired persons by the actual users.

Perceptions of users of writing systems for visually impaired persons in China

The last chapters have established both the need for Chinese Character Braille, in order to make possible character literacy of visually impaired persons in China, and the theoretical and practical possibility of creating such a system. This gave rise to the question of how such a development would be perceived in China, especially compared to the perception of the systems currently used. It also required an investigation into what kind of knowledge of characters the users of writing systems for visually impaired persons in China hold. Since it was apparent that library based research in England could not provide further data to address the questions raised, a field trip was planned and undertaken in Hong Kong, the People's Republic of China and the Republic of China (Taiwan) from 24th August 1993 - 19th December 1993. Users of writing systems for visually impaired persons and individuals involved in decision making concerned with matters regarding writing systems for visually impaired persons were to be approached.

4.1 Methodology

It was accepted that without prior research, or pilot work, attitude measurement and analysis of opinion were not possible. Since no significant prior research in this field had been undertaken and no directly concerned informants or interested bodies were available for discussion in England all parts of this field research have to be regarded as pilot work. As a basis for pilot work unstructured talks to collect all kinds of information possibly relevant for future research were to be undertaken with different respondents who were concerned with Chinese writing systems for visually impaired persons or who were users of Chinese writing systems for visually impaired persons. However, in order to get further and varied information, an attempt was made to include different methods of data collection. Several methods were prepared for possible implementation. It is not suggested that the design of these methods provided for a proper explanatory survey. The groups to be sampled could not be clearly defined in advance since it was not possible to anticipate the responses of the specialist schools for visually impaired persons or other bodies and individuals towards the researcher or the research.

Expected group of respondents

China has an estimated population of 7.5 million visually impaired persons. More than 80% of them live in rural areas and the majority are elderly. Provisions for visually impaired persons are available mostly in urban areas. About 3% - 10% of visually impaired children of school age receive education of some sort. "*Schools for the blind*"

(henceforth referred to as "specialist schools for visually impaired students") and "*Welfare-Factories*" (福利工厂) (institutions which enjoy tax benefits for employing a high percentage of disabled persons) are the only places where it was anticipated that users of writing systems for visually impaired persons would be found in sufficiently large numbers. Since being at a specialist school for visually impaired persons would ensure that the respondents used Chinese writing systems for visually impaired persons on an almost daily basis such schools were targeted. Targeting young respondents would furthermore increase the possibility of finding respondents who had lost their sight in early childhood. Additionally persons considered to be in decision-making positions, with a deeper understanding of questions concerning Chinese writing systems for visually impaired persons, were approached directly or through existing contacts. Since the nature of the group of respondents was relatively unknown to the researcher it was not possible to choose a feasible control group. Therefore as many respondents as possible with many different variables were interviewed. The sample is not considered representative of all visually impaired persons in China.

Research Methods

Fully structured interviews

It was possible to conduct a series of fully structured interviews at 7 specialist schools for visually impaired persons and one university. The schools and the university were located in different areas. Additionally it was decided to interview respondents who were in integrated education in rural areas. (see appendix 1.1.4.) Respondents were interviewed on a one to one basis, using audio taped questions. The questions were closed, which means the respondents had to choose from given answers and the answers were recorded by the researcher on prepared answer sheets. (see appendix 1.1.1, 1.1.2 and 1.1.3.) The average time of each interview was approximately 30 minutes. 219 respondents participated. 211 were either pupils at specialist schools for visually impaired persons or visually impaired students in other forms of education. The average age of the respondents in the fully structured interviews was 17.5 years, with the majority of respondents (141) aged between 13 and 19 years. (see appendix 1.2.24) 194 described themselves as having a visual impairment. 200 respondents declared they could use at least one Chinese writing system for visually impaired persons. 11 knew more than one system and 8 had either just started learning Chinese writing systems for visually impaired persons or did not know how to answer the question whether they knew a "*Chinese Braille system*" (中國盲文). For the analysis, groups with certain variables will be identified to provide for representative samples, for example visually impaired respondents who lost their sight before the age of seven. Where distinction in the

analysis is required the respondents who participated in the fully structured interviews will be referred to as group 1.

Semi structured interviews

A series of semi structured interviews was undertaken. Respondents were usually interviewed on a one to one basis. The interviews were audio taped with the consent of respondents. The respondents were asked 3 open questions, which means the respondents were completely free as to how to answer these questions. (see appendix 2.1.) After this the suggestion that there should be a Chinese Character Braille was discussed. The duration of the interviews ranged from 15 minutes to over two hours. 65 respondents participated, five of them did not agree to the interview being on tape and 37 of them had a visual impairment. The respondents were people directly involved in reform of Chinese Phonetic Braille, administrators and teachers in the field of work of, or work with, visually impaired persons. (see appendix 2.2.) Where distinction in the analysis is required the respondents who participated in the semi structured interviews will be referred to as group 2.

Introduction of a prototype Chinese Character Braille

An experimental introduction of a prototype Chinese Character Braille was undertaken. This prototype Chinese Character Braille will henceforth be referred to as Prototype 1 Chinese Character Braille. One visually impaired teacher and three visually impaired pupils learned the Prototype 1 Chinese Character Braille system which included 100 characters and was based on a decimal numeral representation of Chinese characters. 4 texts in Prototype 1 Chinese Character Braille were produced with appropriate dictionaries, also in Prototype 1 Chinese Character Braille but with explanations in Chinese Phonetic Braille (*xianxing mangwen*). (see appendix 3.1.1, 3.1.2, 3.2, 3.3) The teacher involved in this experiment was briefed by the researcher about the rules of the system and then left to read the 4 texts alone. Following this the pupils were briefed by the teacher on a one to one basis after which they were asked to read the texts on their own. The sessions with teacher and students were video taped with the consent of the respondents. The work with the respondents extended over a period of two weeks. Where distinction in the analysis is required respondents who participated in the introduction of a Prototype 1 Chinese Character Braille will be referred to as group 3

Unstructured talks

For unstructured informal talks the researcher resided in 4 different urban education centres for a total of 9 weeks, and visited rural areas in South and Central China for two weeks. Informal talks took place at any possible location and time, and for no specific length of time.

Group of respondents

In all lines of investigation those who responded did so voluntarily. They were not a homogeneous group. For example, some had received no, or very little, education while others had received university education. The age at which the respondents had started education varied from 5 or 6 years to 16 and 17 years and age could therefore be a quite misleading variable. Some had lost their sight immediately after birth, some much later in life. This of course influenced what kind of education they had had before they went to a specialist school for visually impaired persons or whether they went to a special school at all. Several of the respondents seemed to have given up hope, not only due to their disability but also as they faced very limited possibilities in society. Others were very keen to learn and sought opportunities beyond those available.

A discrepancy in representation of female and male respondents was caused by availability of respondents. In group 2 all directors of specialist schools for visually impaired persons and people in decision making positions were male. The only women available for semi-structured interviews were teachers at specialist schools for visually

impaired persons. Approximately two thirds (66%) of the respondents of the fully-structured interviews were male, a number which appeared to represent the percentage of male students at the schools.

Caution

The researcher spoke to over 300 respondents, travelled to Taiwan and Hong Kong and to 5 provinces on the Mainland in a period of four months. All the work and programme had to be organised after arrival. The main difficulty of the field-work was the intense work-load which from the very beginning was exacerbated by the fact that more lines of investigation were made possible than had been expected. There was no time for adjustments after arrival in China. The data collected under such pressure will be considered with appropriate caution.

The research concentrated on responses concerned with knowledge of characters, learning of characters and the possibility of a Chinese Character Braille system. The possibility of bias caused by this has been taken into account and the analysis will be undertaken with the necessary caution.

In the different circumstances of investigation the question of power-relationships between respondent and researcher was considerably different. The impact of this on the responses and the results of the investigation has been taken into consideration. Where the power-relationship between respondent and researcher was expected to lead

to a negative experience for the respondent, efforts were made to reempower the respondent.

Since the main part of the field research was conducted at specialist schools for visually impaired persons, the anxieties of teachers and the heads of the visited schools had to be addressed. A survey conducted in "their school" which entailed an outsider examining "their students" apparently presented the possibility that the results of the investigation could be linked to the school's general performance and in particular the teaching. These anxieties are most vividly expressed in a letter by a teacher to the researcher:

> ... because the totally blind students at our school have not learned the Chinese characters for the sighted, basically none of them could answer the questions 52-65 [The Chinese character test sequence in the fully-structured interview]. Furthermore, since the students are not old and they have not been at school very long, their opinions and judgements towards certain questions are not sufficiently mature and therefore their level of credibility is not very high. Of course, from that you can also see some of the shortcomings in the education and teaching at our school, please make suggestions. (Respondent 63)

This teacher apparently links the results of the research directly to the teaching at the school and, by doing so, to his own work. Teachers and especially the heads of the schools were generally very anxious about the research. To be allowed into the schools to undertake this kind of investigation therefore required good introductions by a trusted person. The researcher received such introductions. Once at the school, to dispel remaining anxieties, it was vital for the researcher to first establish a solid base of trust between himself and the heads of schools and the teachers. Therefore, on several occasions the

researcher promised that in analyzing the data no direct link with any one school or any one teacher would be made public. The presentation of the analysis below will be of a kind which ensures that it is not possible to link the results to any individuals or bodies.

Language problems were obvious in the design of the fully-structured interview. Cantonese had to be used for Cantonese only speaking respondents and the presence of an interpreter was required. The wording of the questions in the fully-structured interview was designed for respondents on the mainland. It was decided to use what was considered the most commonly used terms there, like for example "blind", *mang* (盲) when referring to visual impairment and "Braille", *mangwen* (盲文), when referring to Chinese Phonetic Braille. When the term *mangwen* was used in a question it will be referred to as Chinese [Phonetic] Braille in this study. Using terms which were considered common in the People's Republic of China, however, caused problems both when translating them into Cantonese and when using the *putonghua* version in Taiwan. For example, the word commonly used for Braille on the mainland is "blind-writing", *mangwen* (盲文), while in Taiwan the word "dot symbols", dianzi (點字), is common. The word for "visually impaired person" commonly used in Hong Kong is "lost sight person", *shimingren* (失明人), and the expression "blind person", *mangren* (盲人), as used on the mainland is considered rude. In all locations some respondents were familiar with and some used the term "visual impairment", *shili zhangai* (視力障礙). Similar problems appeared with the expression "School for the Blind", *mangren xuexiao*

(盲人學校), where the word used on the Mainland is considered very inappropriate in Taiwan. The extent of these problems only became obvious during the field work.

Accordingly, as regards the wording of answers and their translation appropriate caution was taken throughout the investigation.

In the following, perceptions of Chinese Phonetic Braille are investigated followed by perceptions and knowledge of characters. After this perceptions of a possible character Braille are discussed.

4.2 Perceptions of Chinese Phonetic Braille

In the informal talks the respondents appeared to be generally content with the system they were using and to appreciate the fact that it constituted a writing system for visually impaired persons. Nevertheless, as could be expected, there was a general awareness of the problems of Chinese [Phonetic] Braille amongst almost all respondents. One respondent put it most pointedly:

> Chinese [Phonetic] Braille is a system with a disability used by people with a disability. (Respondent 38)

Asked about the advantages and shortcomings of Chinese [Phonetic] Braille the respondents of group 2 voiced rather stereotypical views. The main positive argument about Chinese [Phonetic] Braille used in all three main locations was that it is easy to learn, much easier than the characters. This was thought by some to compensate for other

difficulties visually impaired persons experienced when learning. The main problem with Chinese [Phonetic] Braille was generally described as being the uncertainty created by different characters represented by the same sound, *tongyinzi* (同音字). Under this description fell a whole range of problems of Chinese [Phonetic] Braille, as indicated in the previous chapter about Braille reform, but mainly concerned with comprehensibility while reading. Several respondents, however, also volunteered the observation that visually impaired persons do not, or cannot, use Chinese characters through the medium of Chinese [Phonetic] Braille (Respondent 28). In group 1, 29% of respondents were apparently satisfied with Chinese [Phonetic] Braille, saying it did not need reform. However, only 14% thought that Chinese [Phonetic] Braille could be used for all purposes in question and only 12% thought that Chinese [Phonetic] Braille did not need reform and could be used for all purposes in question.

Although for each of the various individual purposes listed below a majority of respondents in group 1 believed that Chinese [Phonetic] Braille could be used (See appendix 1.2.6), 83% thought that Chinese [Phonetic] Braille could not be used for at least one of the purposes. The sequence of answers presented below reveals an understanding of the problems created by different texts and the difference between reading and writing.

"Do you think blind persons using Chinese [Phonetic] Braille can":

	cannot	can	don't know
write character riddles :	37%	57%	6%
read Xunzi :	35%	48%	17%
write computer manuals :	25%	65%	10%
read computer manuals :	23%	70%	7%
read tang poetry :	20%	79%	1%
read economic texts :	19%	71%	10%
write classical Chinese :	18%	77%	5%
write philosophical text :	14%	75%	11%
write political text :	9%	77%	14%
read newspapers :	9%	87%	4%
write novels :	3%	95%	2%

An issue which many respondents closely connected with the question of comprehensibility of Chinese [Phonetic] Braille was the use or non-use of tonal representation with each syllable. Having tonal representation added without proper rules or not having tonal representation with each syllable was considered by many a disadvantage of *xianxing mangwen*, the system used in the People's Republic of China. Having the tones added in *guoyu dianzi*, the system used in Taiwan and *zhongwen yueyin dianzi*, the system used in Hong Kong was generally considered an advantage by its users. On the other hand it was pointed out, mainly on the mainland, that having to add tonal representation not only increased the volume of Chinese [Phonetic] Braille but also caused a considerably increased workload when learning to write. Some respondents argued that the addition of tonal representation in a writing system for visually impaired persons would not improve comprehension to a level justifying the increased effort required. Especially so, taking into account also the problems created by the increased volume. Such views on this issue were prevalent in the discussion between the three different locations about unifying Chinese [Phonetic] Braille and also in the arguments

about the introduction of *daidiao shuangpin* on the mainland. Several respondents voiced their disappointment that there is no uniform Chinese writing system for visually impaired persons for Hong Kong, Taiwan and the People's Republic of China. When asked what reform efforts they would want, respondents most frequently put forward the idea of unifying the Chinese writing systems for visually impaired persons.

The majority of respondents were generally content with the writing systems for visually impaired persons used for science and music but some respondents voiced their reservations. This was underlined by the responses of group 1, although fewer respondents said that writing systems for visually impaired persons used for science and music would need reform compared to Chinese [Phonetic] Braille in general (See appendix 1.2.16).

Asked whether or not Chinese [Phonetic] Braille could be used to communicate with the sighted, 62% of the respondents of group 1 thought that this was possible. However, compared with other means for communicating with the sighted such as *hanyu pinyin* (75%), Chinese characters (67%) and foreign languages (71%), Chinese [Phonetic] Braille came last.

Concerning the perception of Chinese [Phonetic] Braille by its users, it appears that about one quarter or less of the respondents are completely content with the system while a strong majority of users

showed understanding of the problems created by the system. The majority of respondents were in favour of changes to the system, although it is unclear what kind of changes these would be. The most prevalent question under discussion during the investigation was that which concerned the addition of tonal representation to increase comprehensibility of the Chinese [Phonetic] Braille system on the mainland. The unification of all writing systems for visually impaired persons was frequently mentioned, while the direct link between using Chinese [Phonetic] Braille and not knowing characters was rarely made.

4.3 Perception of Chinese characters and the possibility of learning them

Throughout all parts of the field-work it appeared obvious that the majority of both sighted and visually impaired respondents perceived Chinese characters solely as characters for the sighted, which means they solely considered the *Corpus* of the character as a character. The answers of group 2 to the question "Do you think blind persons can learn Chinese characters?" suggested that most respondents consider learning Chinese characters has to be learning the characters for the sighted, i.e. has to be learning the *Corpus* of characters. The respondents mostly referred to characters as being very difficult to write by hand and suggested that partially sighted students should indeed learn characters, but that for visually impaired students this would be very difficult. Some suggested that visually impaired students should at least learn to write their own names. One teacher even suggested that visually impaired persons could learn enough to

sufficiently write the *Corpus* of characters and referred to an experiment of his own in which he had taught some visually impaired students to write several hundred characters for the sighted by hand (Respondent 37). Respondents who had previously been concerned with the coding of Chinese characters were amongst the only respondents who volunteered, in response to this question, the suggestion that learning a character-code rather than the *Corpus* of the characters would be a possibility for visually impaired persons (Respondent 19). One might argue that there is nothing unusual about this since "characters are characters for the sighted" for most people but it is important to remember at this point that the respondents were all users of Chinese Phonetic Braille and their medium of writing is by no means a medium designed or perceived as being for the sighted. In fact the medium they use has no connection to the *Corpus* of the character whatsoever.

The respondents of group 1 rated the possibility of visually impaired persons learning characters compared to learning other skills as follows, answering the question below with "can":

"Do you think you yourself can learn?":

music	90%,
Chinese chess	76%,
knitting	76%,
computer	67%,
typing an English typewriter	67%,
Chinese characters	**56%,**
farming	29%.

With the exception of farming a majority of respondents believed themselves able to learn the skills discussed. Learning Chinese characters came above farming. Judging by the response of group 2 it

has to be assumed that this refers to learning the *Corpus* of the characters. However, with 56% of respondents in the group thinking it is possible to learn characters they appear to be much more positive about this than group 2. One respondent of group 2 attributed this more positive attitude to the lack of experience of the respondents in group 1, who had not gone through the hardship of learning Chinese characters: "When you are young you do not fear the tiger" (Respondent 33).

There was a consensus in all groups of respondents that in China knowledge of characters is important. Asked about the importance of knowing characters in order to succeed in China only 13% of group 1 considered this not to be important. Nevertheless it was considered less important than all the other issues in question, as shown in the answers to the question below.

"Do you believe the following attributes to be not important, a little bit important, or very important for the success of a Chinese person."

	very important	a bit important
being nice	83%	14%
having a good education	82%	12%
being intelligent	65%	31%
having good friends	64%	29%
having sight	43%	40%
knowing characters	43%	41%

The question about characters was answered as being not important by 13% and 2% said they could not answer. The number of respondents who answered "Do not know" and "not important" to the other answers was negligible.

Although characters are last on this list they are still considered very important by a majority, even if not an absolute majority, of respondents. Rating characters lower, along with sight, might, however, be a reaction to the social reality of them both not being available to visually impaired persons.

Concerning the perception of characters it has to be concluded from the responses that characters are perceived as characters for the sighted. The respondents generally appreciated that knowledge of characters is very important in Chinese society. Although the characters are difficult to learn, the majority of respondents in group 1 think that they can learn them.

4.4 Knowledge of Chinese characters

One main assumption of the last chapters was that by using Chinese Phonetic Braille visually impaired persons do not acquire knowledge of Chinese character script which would enable them to use this knowledge creatively in writing or in reading. In the following this assumption will be investigated. Asked how many individual characters they know, 55% of visually impaired respondents in group 1 who had lost their sight before the age of seven said they did not even know one character.

Characters	
0	55%
<= 10	24%
<= 100	20%
> 100	1%

Of those who said they knew no characters at all 79% could still give an explanation of all or some characters used in their own name. Such explanations, which could be used to verbally identify the character will henceforth be referred to as verbal identification. The fact that some respondents thought they knew nothing while they apparently knew something about characters confirmed that the respondents' perception of characters was much more narrow than the one laid out in chapter 1. (see page 17ff) This gave rise to the question of how to define knowledge of characters for the purpose of a test. For the purpose of this test knowledge of Chinese characters is defined as follows:

Except for being able to identify a character by vision, one knows a character when one can identify an individual character by:

> the words it is commonly used in as a lexical compound,
> the number of strokes used in it,
> the graphic component it is ordered under,
> its general, well known characteristics.

This definition does not take into account whether or not somebody knows how to use this knowledge productively. All these four characteristics, when used in verbal identification as used in the test, were generally known to the sighted respondents, who have learned characters. One sighted Cantonese speaking respondent admitted to not understanding Questions 52-55, but all other sighted test respondents had no problem in answering the test sequence.

143 respondents who had lost their sight before the age of seven were presented with a character test sequence of a very easy nature. The test sequence consisted of 11 relevant questions concerned with either of the four characteristics as laid out in the definition (See appendix 1.6.1 – 1.6.4).

Not one of the respondents answered all questions correctly. Three respondents answered just one question incorrectly or said they did not know an answer. 140 respondents (98%), however, answered three or more questions incorrectly or said they did not know the answer.

Since the test was of a very simple nature and could be answered by sighted respondents with little or no problem it can be concluded that, according to the definition given above, visually impaired persons in China who have lost their sight before having received education for the sighted do not hold significant knowledge of Chinese characters, since they cannot identify individual characters either by vision or by any other means.

However, the investigation did establish that the respondents held some knowledge of characters other than just knowing the form for the sighted. Assuming that there may have been lucky guesses, it cannot exactly be judged who precisely knew the characteristics in question. However, the percentages of the answers given indicate that respondents knew at least some aspects of the answer. This became especially apparent in the answers to Question 62 where 38% of

respondents answered correctly while only 9% answered incorrectly and the remainder did not claim to know. Several respondents declared later that they knew that "ren as in people" (人) had only two strokes and that they thought it was unlikely that "ren as in knowing" (認) had even less strokes. The fact that the respondents held at least some knowledge also became very clear in the answers to Question 65 where respondents had to answer a question to which neither of the given answers was in fact correct. Despite this 11% of respondents answered correctly. Further talks after the interviews confirmed that not all respondents were guessing the answers. When respondents were challenged about answers in this section their responses varied significantly. Some admitted freely that they were guessing while others considered their opinion about characters to be correct even if it was wrong, for example when they were convinced that characters had to be different if their pronunciations were different. The most revealing, and at times emotionally very moving responses, were, however, from some students who told how they had gained their correct knowledge of characters. Several students spoke of how they had listened to their sighted brothers or sisters when they learned characters and others told of their mothers who had patiently explained characters to them. On the other hand some respondents were reluctant to say that they could not answer a question and admitted only later that they had guessed instead. This reluctance to admit not knowing the characters was sometimes clearly linked to the embarrassment caused to the respondent by this fact. Below are the results of the test sequence in absolute numbers and percentages.

Question	not know	wrong	right
No 52.)	63 (44%)	37 (26%)	43 (30%)
No 53.)	65 (45%)	18 (13%)	60 (42%)
No 54.)	66 (46%)	15 (10%)	62 (43%)
No 55.)	56 (39%)	48 (34%)	39 (27%)
No 57.)	65 (45%)	4 (3%)	74 (52%)
No 59.)	75 (52%)	13 (9%)	55 (38%)
No 60.)	99 (69%)	20 (14%)	24 (17%)
No 62.)	73 (51%)	13 (9%)	55 (38%)
No 63.)	93 (65%)	19 (13%)	31 (22%)
No 64.)	104 (72%)	27 (19%)	12 (8%)
No 65.)	96 (67%)	31 (22%)	16 (11%)

Due to the number of respondents who answered: "I do not know" it appears that the respondents believed that they could identify characters rather by the words they were used in as lexical compounds than by the numbers of strokes used in them. A closer analysis of the individual questions, however, shows that not one of the characteristics stood out as being easier to identify. It became apparent that in each of the sections the characteristics of some characters were better known than others. This would indicate that the more commonly known the characteristics were, the more likely the respondents were to be able to identify them. The respondents appeared to not always know both characters in question, but to be making guesses from the character they knew more about than from what they knew about both characters, as for example in Questions 57 and 59.

This seems to indicate that as an underlying principle it might be more successful to draw on commonly known characteristics of characters of

a different nature rather than solely on one kind of characteristic. This question will need to be further investigated by establishing commonly used verbal identification and analysing whether there are preferred principles and if so what they are.

When visually impaired respondents who had lost their sight later in life undertook the test sequence, 20% could answer all questions correctly. 19% of partially sighted respondents could answer all questions correctly, taking no account of the time when their deteriorating sight was diagnosed.

Challenged about their answers visually impaired students who lost their sight later in life often showed significant knowledge of characters but admitted that they forgot more and more the longer they were not using Chinese characters. Generally respondents held either a profound knowledge and made no mistakes or they made lots of mistakes. 1 or 2 mistakes and 1 or two correct answers were rare.

While, as assumed, visually impaired persons who lost their sight before they received education for the sighted hold no coherent knowledge of Chinese characters it became clear that they hold a patchy knowledge of the different characteristics of Chinese characters. This knowledge is so far not extended by teaching at schools and has been obtained circumstantially. Visually impaired persons who lost their sight later in life often still have significant knowledge of characters but lose this increasingly the longer they do

not use it. Education for partially sighted students to read large print characters has only just begun and therefore they too hold only limited knowledge of Chinese characters.

4.5 Perception of Chinese Character Braille

The next question to be investigated was how the respondents perceive the suggestion of a Chinese Character Braille system.

After taking some time to consider this issue the administration on the mainland made it clear, informally, that such a system would not be likely to meet with a positive reponse for the time being. However, it was at least politely considered an option for the more distant future. Nevertheless, amongst users and educators as well as some of the administrators there was a considerable number of respondents who remained undecided if not in support of such a possibility.

Presented with the suggestion of a Chinese Character Braille the virtually undisputed main argument, put forward by group 2, in favour of a Chinese Character Braille system was the fact that it would facilitate better communication with the sighted, both in reading and writing. The value of such a system was regarded by some as going much beyond simply the aspect of communication. Some respondents made it clear that they would only consider themselves as real Chinese when they were able to master Chinese characters (Respondent 34). Despite this general feeling numerous reservations were voiced.

Apart from the simple and not very productive response: "I simply do not like the idea" three main reasons were given as grounds for objection to such a system. The first one was the belief that visually impaired persons could not learn so many characters. This is an assumption that has by no means been proven and has to be considered rather derogatory despite the fact that it has been voiced by visually impaired persons. This study has found no evidence to suggest that visually impaired persons are not able to learn as many symbols as sighted persons.

A far more significant argument is the question of resources. In a country where millions of visually impaired persons still wait for a simple cataract operation to restore their sight, where at the most sympathetic estimate, about 90% of visually impaired children are not receiving any education or special attention at all, the distribution of resources is indeed of high significance. This argument was raised mainly by the distributors of resources and the respondents who opposed a Chinese Character Braille system in general.

The other very significant argument often voiced by users and educators concerned the effort that would be required to learn a Chinese Character Braille system. The concern about the significantly increased workload laid on the shoulders of visually impaired persons, by learning a Chinese Character Braille system rather than, or in addition to, the currently used Chinese Phonetic Braille, was strongly voiced by some visually impaired respondents. One aspect of this

concern was that putting in so much effort would have to be rewarded in terms of education and work environment. As long as there were no job opportunities in which one could use Chinese Character Braille it would not be worth learning. Although this argument is perfectly justified, it creates a vicious circle, since as long as there is no Chinese Character Braille system, no working environment will develop, and as long as there is no working environment the respondents do not want to attempt to learn such a system.

Another indirectly voiced concern about the effort needed to learn Chinese Character Braille came from the partially sighted respondents. In all three main locations some partially sighted respondents said they preferred to use Chinese Phonetic Braille rather than large print characters, since, as they said, the character script was so much more difficult to learn. On the other hand, and directly contrary to this attitude, there were partially sighted respondents who desperately wanted to learn large print characters and felt they were being made artificially "*blind*" by the fact that they had to use a writing system for visually impaired persons in their education. The first response is directly in contrast to previous findings in the West where partially sighted children are very reluctant to learn Braille since, amongst other reasons, it appears the most apparent proof of their visual impairment. The different reaction of partially sighted respondents in China almost certainly has to be regarded as a reaction to the difficulty of learning Chinese character script and raises the issue of choice which will be discussed later.

Those who made suggestions about the development of a Chinese Character Braille system repeatedly put forward the idea that such a system should be as close to existing reading patterns and should make as many links with Chinese characters for the sighted as possible. This would not only help in teaching such a system but also make it easier to communicate with the sighted about characters in other than a written form.

> "There is not much point in such a system if a sighted person asks you what your name is, and you say Li, and he asks what Li, and you say: dots three, five, three four five."
> (Respondent 34)

This example clearly illustrates the essential contradiction and will, therefore, be frequently referred to in the following chapter about creating a Chinese writing system for visually impaired persons.

In the following the reaction of group 3 respondents who wanted to learn characters and were presented with the Prototype 1 Chinese Character Braille system will be discussed.

In the hope that visually impaired teachers and students who would like to learn such a system could be found, this prototype with 100 Braille units for a Chinese Character Braille system was prepared in advance. (See appendix 3.1.1, 3.1.2, 3.2, 3.3) At one school a visually impaired teacher was given the material and asked to consider teaching it to several students. After a period of consideration and after having learned the system, the teacher agreed to do so. Subsequently three

students were asked to participate and were taught the system by the teacher in the presence of the researcher. Changing the teaching method with each student, the students were taught the system and had to read four small texts in Chinese Character Braille and produce three sentences in Chinese Character Braille. All participants mastered the system. Two respondents mastered the system in less than a day, one respondent needed slightly longer. The results were very encouraging, even if the extremely positive results must be viewed critically, taking into account the small scale of the experiment and since, in anticipation of greater problems, the texts and the dictionary had been kept very simple. However, the four respondents had no problem in changing their perception of Chinese characters and no problems using a "Chinese Character Braille - *xianxing mangwen* dictionary" to read four texts in Chinese character Braille without outside help. At the end of the experiment they were all willing to learn more of the system. Asked whether they would use such a system if available on a required scale of several thousand characters, all four participants said that they would do so.

With regard to the question of what kind of units to use in a Chinese Character Braille system the general suggestion of the teacher and students who have been taught the Prototype 1 Chinese Character Braille system, as of some other respondents, was to use individual cells as parts of units, rather than to leave large poly-cell units without explanation. The participants had been presented with different

methods for learning the units and found it more difficult to learn them when the individual cells were not explained or named.

Taking into account the possibility that the four respondents were to some extent trying to please the researcher, the fact remains that none of them had any serious problem in learning and using 100 coded characters in a very short time. Having established some of the arguments surrounding the question of whether or not a Chinese Character Braille system is feasible, the essential remaining issue appears to be freedom of choice.

4.6 Choice

The research concentrated on educated persons in decision making positions and students, and met with considerable objections to change and especially with objections to the suggestion of a Chinese Character Braille system amongst this group. In particular respondents who opposed the suggestion of a Chinese Character Braille system expressed an opinion which seems to be supported throughout by the argument of the severely increased effort needed to learn Chinese Character Braille. It was suggested by some respondents that the objection to such a system would be much stronger amongst visually impaired persons already in work. The respondents assumed, that in the workers' experience a pronunciation-based system was not only sufficient, but a Chinese Character Braille system would be of very little additional use. No research has so far been undertaken to support this claim. However, it has to be accepted that forced into a

disempowered situation by a desolate educational system and a "no or hardly any choice jobmarket" the prospect of having to learn a difficult writing system which may be of little use to the individual may not appeal to any member of society. This was also underlined by the findings from visits to the countryside. The kind of education visually impaired students received there was so basic that a pronunciation-based writing system for visually impaired persons appeared to be sufficient. Such a system also helped students in remote parts of China to acquire a better knowledge of standard Chinese (*putonghua*) than their fellow students and at times better than their teachers. With the extremly remote prospect of computers becoming available for those students to write characters, one of the main advantages of a Chinese Character Braille system, the possibility to freely write ink print Chinese character script, would clearly not come into effect in the near future, while the advantages of Chinese Phonetic Braille were already enabling the students to make fast progress in class.

However, other issues contributing to the question of choice should not be ignored and deserve to be further investigated. It was, for example, found that visually impaired parents with sighted children feel their lack of knowledge of Chinese characters to be a particular handicap. While being able to provide for their children in just the same way as sighted parents they cannot do so when their children learn Chinese characters. Visually impaired parents voiced particular frustration about this and it might be assumed that the wish to help their

children in their education may, amongst many other issues, also influence choice in this matter.

While the sighted members of society have no choice in this matter, since they have to learn characters at school, visually impaired members of society might have such a choice in the future. So far of course they also have no choice since they are, as a result of the absence of a Chinese Character Braille system, forced to use a Chinese Phonetic Braille system.

Each individual, faced with such a choice might for very different reasons come to a different solution as to whether to learn such a system or not. Some might be too disillusioned about possibilities for themselves in society, find it more appropriate that everybody learns *hanyu pinyin* or be simply too lazy to learn characters. On the other hand some might believe such knowledge to be essential or might want to learn characters purely out of curiosity. The issues influencing this choice are numerous and individually determined. The responses throughout this field-research were marked by this choice, or non choice. This, while the main arguments about reform of language, written style and script in China still apply, puts the situation of writing systems for visually impaired persons in a different light. Compared to the discussions the sighted found and find themselves in, where one of the choices was whether or not to abandon Chinese character script in favour of a phonetic script, visually impaired persons are, if a Chinese Character Braille system is presented to

them, in a situation where they can choose whether or not to abandon a phonetic script in favour of Chinese Character script.

The following attempts to establish some of the issues concerning the choice of visually impaired persons in relation to this question. The suggestion of a Chinese Character Braille system raised strong objection as well as strong support, although a majority of undecided respondents were found in all three main locations.

Amongst those who argued either in support of or against such a system it became apparent that those who were most enthusiastic about changes in the existing system were also those who most strongly felt the restrictions of the current system and the restrictions caused by not knowing characters, while those who rejected the idea out of hand seemed quite content with their knowledge and possibilities or believed a change to be too difficult. The strongest supporters of the suggestion of a Chinese Character Braille system often volunteered arguments against Chinese Phonetic Braille, with which the researcher was familiar and which were mentioned in the previous chapters on reform of Chinese Phonetic Braille. Similarly, the objections to a Chinese Character Braille system were mostly based on arguments for the currently used Chinese Phonetic Braille, especially the argument that Chinese Phonetic Braille is easy to learn and that Chinese Character Braille would be too difficult.

To establish further what might influence the choice regarding the suggestion of a Chinese Character Braille system the responses to questions presented to group 1 will be examined more closely. One of the questions posed to group 1 was:

> "The sighted say learning Chinese characters is very difficult. Do you yourself want to learn Chinese Characters?"

Although the question was designed to be slightly leading indicating that learning characters is very difficult the responses were

		want	don't want	don't know
all	(216)	75%	20%	5%
vis. impaired	(193)	73%	22%	5%
remain. Vision	(23)	91%	4.5%	4.5%

This does not conclusively indicate that 75% of respondents would want to learn a Chinese Character Braille system but it will be assumed that the objection to learning such a system amongst the respondents who say they want to learn characters despite this being difficult, is less than amongst those who say they do not want to learn Chinese characters. To investigate whether there are significant qualities characterising the group who answered that they would want to learn Chinese characters compared to the group who said they would not want to learn them, all available variables as established in the fully structured interviews were compared (See appendix 1.3.1 - 1.3.80).

First the parts where no differences were found are discussed. No significant difference was found correlating with the different status of the respondents. There were also no differences according to age-

groups and the sex of the respondents. The length of time when schooling was received also appeared not to strongly influence the respondents' choice. There was no significant difference between how the two groups compared visually impaired persons to sighted persons although there was a small trend within the group who did not want to learn characters to believe the sighted to be better at certain jobs. There was no significant difference between the two groups in the evaluation of applicability of Chinese Phonetic Braille, the importance of knowledge of Chinese character script compared to other aspects in life, and in the evaluation of the possibilities provided by computers.

In the following the parts where differences were apparent will be examined. The significant differences were in eyesight and in when the respondents had lost their eyesight. Only one of the respondents who said they would not want to learn characters had remaining vision. Since, except for one, all partially sighted respondents in group 1 answered that they would like to learn the characters the following analysis will concentrate on the choices of visually impaired respondents with no significant remaining vision only.

Amongst visually impaired persons who lost their sight before the age of seven and therefore had little or no visual impression of Chinese characters, there was a significantly higher proportion who answered that they would not want to learn them compared to those who lost their sight later in life. The establishment of a trend clearly indicates that the later visual impairment occurred the more willing the

respondents are to learn characters, and conversely the earlier it occurred the less willing they are to learn them (See appendix 1.3.3).

The answers given to individual questions differed in different regions but over all it appears that no significant influence is due to where the respondents came from. At one school all respondents said they would want to learn characters. An analysis of the answers from this school, however, did not come to any other conclusions than the following and it appears that unidentified variables were responsible for the outstanding results at this particular institution. The only significant regional difference in the question of choice is the availability of English Braille in Hong Kong both for education and vocation. This seems to have influenced the choice of respondents.

Further differences were found when the respondents were asked about whether visually impaired persons can do particular jobs and whether the respondents themselves could learn certain tasks. The respondents who did not want to learn characters showed less confidence in visually impaired persons in general and also in themselves (See appendix 1.3.7 - 1.3.20). While 67% of the group who want to learn characters actually think they could learn them, only 19% of those who do not want to learn them believed they could learn them (See appendix 1.3.16).

The character test sequence also produced a clear difference between the two groups. The respondents who did not want to learn characters

had continually answered more often that they would not know any of the characteristics and they also had fewer correct answers (See appendix 1.3.46 - 1.3.57). The respondents who do not want to learn characters also showed a significantly lower level of knowledge of the characters used in their own name.

When asked whether phonetic transcriptions could be used to communicate with the sighted, significantly more respondents who did not want to learn characters believed that *hanyu pinyin* could be used to do so. In comparison, significantly more respondents who answered that they wanted to learn characters believed that characters could be used to communicate with the sighted (See appendix 1.3.63 and 1.3.65).

When asked whether or not Chinese [Phonetic] Braille needs reform the respondents who wanted to learn Chinese characters were more likely to assume that Chinese [Phonetic] Braille needs reform. Accordingly the percentage of respondents who did not want to learn Chinese characters, who thought that Chinese [Phonetic] Braille would not need reform and that there were no problems with Chinese [Phonetic] Braille in the areas in question, was higher compared to the percentage of respondents who did want to learn character script and thought Chinese [Phonetic] Braille sufficient (See appendix 1.3.35 - 1.3.45 and 1.3.77).

Since the most significant attribute of the group of respondents who did not want to learn characters was that more of them thought they

could not learn the characters, some available variables were also compared for the groups who thought they could or could not learn characters. This confirmed the link between the belief in not being able to learn characters and not wanting to learn them (See appendix 1.4.1). While 41% of all respondents who think they cannot learn characters also do not want to learn characters, only 4% of respondents who think they can learn characters do not want to learn them. Again, it was mainly visually impaired respondents without significant remaining vision who answered that they could not learn characters and clearly fewer visually impaired students with remaining vision who also answered this way. Those who thought they could not learn Chinese characters were younger with an average age of 16.4, than those who thought they could, although age appeared not to have influenced opinion on other questions. Again more respondents who had lost their sight early in life thought they could not learn characters. An analysis confirmed the same trend as in the question of whether respondents wanted or did not want to learn characters (See appendix 1.4.2).

The respondents who said they could not learn characters said of themselves that they knew far fewer characters, also with a similar trend to the group who answered that they did not want to learn Chinese characters (See appendix 1.4.3). Accordingly, 18% of respondents who thought they could not learn characters could not explain any of the characters in their name while only 2.5% of those

who thought they could learn them could not explain their name. (See appendix 1.4.6)

To see whether respondents who said that they could neither learn characters nor did they want to learn characters showed any consistent difference to other respondents, a large sample of the answers of this group were compared (See appendix 1.5.1 - 1.5.16). These confirmed the above findings.

The question of choice is highly personal and influenced by many variables, many of which this investigation could not identify. Nevertheless, it appears that the belief that one cannot learn characters influences the decision not to make an effort to learn them. Assuming that belief in the inability to learn characters stems from the lack of experience of such knowledge, this would indicate the existence of a vicious circle of self-exclusion from this knowledge. This circle has obviously been broken either by the patient teaching of mothers or the curiosity of some just listening to the sighted. It appears that those respondents who want to learn characters, do, or have done, this already more often than the respondents who do not want to learn them.

Having analysed all available variables the responses to Question 85 were generally consistent. Although tentative, it can therefore be assumed that about 20%-25% of respondents in group 1 seem to have no or little interest in learning characters or believe it to be impossible.

The respondents in this group are more likely to have lost their eyesight early in life and to be less confident about the chances of visually impaired persons. Equally the findings would support the hypothesis that an increased knowledge of characters would also improve acceptance of the suggestion of learning Chinese characters.

4.7 The effect of computerisation

Availability of computer-technology apparently had a considerable impact on the respondents and it will therefore be discussed in more detail. The main issue in this respect was the often uncritical belief that computers as such could solve all problems of Chinese Phonetic Braille. This belief was found in all areas of investigation. A quote from a senior sighted person in a decision making position makes quite clear how an early uncritical belief only slowly changed in view of consistent failure to produce a promised result:

> I had been told that by developing a computer programme we could make it possible for the blind to use Chinese characters freely still using the existing Braille system. They have tried that for some years now and it became increasingly clear that it won't be possible. I have changed my mind now and believe that the blind have to learn characters one way or the other. (Respondent 59)

How strong the belief in computers is throughout is also shown by the figures produced by group 1. The questions about the use of computers in Character - Braille conversion and vice versa were answered positively by a very strong majority of 80% and 83% (See appendix 1.2.15). Furthermore, and also connected to the availability of computer technology, the supporters of a Chinese Character Braille code thought that such a code would only make sense if it would make

unaided communication with the sighted through the use of computers possible.

Therefore, computerisation had two adverse effects. On the one hand it is argued that computers as such can solve all the problems of Chinese Phonetic Braille thus making a Chinese Character Braille obsolete. On the other hand computerisation is considered the tool which gives sense to a Chinese Character Braille system by enabling visually impaired persons to actually write characters. In the argument about Chinese Character Braille it will therefore be necessary, not only to prove that whatever the computer system, learning characters is essential, but also that Artificial Intelligence can never fully solve the issues raised by the dual use of character script and pronunciation based representation, as in Chinese Phonetic Braille.

4.8 The decision making process

The interviews with group 2 clearly revealed that the underlying political structure which made it possible that Chinese Phonetic Braille could be unified on the mainland as *xianxing mangwen* and to make this system extremely popular in a very short time, has not significantly changed since the early 1950s, despite seemingly significant changes on the surface. One of the characteristics of this structure is that very little documentation of the decision making process is available. The decisions were and are made in an extremely centralized way. The decision to use *xianxing mangwen* was made either before the *Association for the Blind* (中國盲人協會) was even founded or was

amongst its first decisions. It must therefore have been made within a very short space of time and without widespread consultation. The decision to change to *daidiao shuangpin* was made by the China Disabled Persons Federation which was newly established in 1988. In his speech to the tenth meeting of the delegates of the Welfare Fund for the Handicapped 25/05/1994 *Deng Pufang*, the president of the China Disabled Persons Federation announced that:

> the Plan for double-cell syllabic spelling of Chinese [Phonetic] Braille [*hanyu shuangpin mangwen fang'an* (漢語雙拼盲文方案)] is decided..."
> (Deng, 1994: 6)

There is no documentation available on how the decision was made but from one of the respondents we learn that there was a decisive meeting about the matter in July 1991, at the Fragrant Mountains near Beijing (Respondent 33). Who participated in this and previous meetings and how the decision was reached is not known. It is clear, however, that strong opposition was voiced, and that some of those who voiced it still do not believe that the decision is final. (Respondent 26) It also became very clear from the responses of those interviewed that in the decision making process *Huang Nai* has been, and still is, the most influential person. This research could not establish the precise pattern of the decision making process and can only suggest that this should be a matter for further investigation. It can, however, affirm that it is a rather secretive process, both to foreigners and Chinese alike and that this causes considerable frustration at least amongst some users of such writing systems. Decisions are made centrally and are announced by the leaders and it appears unlikely, due to lack of

documentation, that the processes behind this decision can be properly traced. Not only was the decision to use *daidiao shuangpin* from 1994 onward made through this process, but the decision not to move on to a Chinese Character Braille system in the near future also evolved from this.

In the following the few available facts known about the decision-making process are summed up:

On the mainland the argument about the future of writing systems for visually impaired persons had already developed in the years of the surge for reform of language, written style and script. Two groups could be identified:

- The group which supported *xianxing mangwen* developed by *Huang Nai* (*Huang Nai* Group).
- The group which advocated a Chinese Phonetic Braille system using Braille cells directly representing the symbols of *hanyu pinyin* which would therefore also be close to English Braille cell forms (The "orthodox pinyin group").

The argument between the two groups appeared to be quite fierce at times and winning or losing seemed to be of great importance to individual participants. There were also suggestions that decisions about the future of the writing system for visually impaired persons were dependent on how close persons were to the political elite of the time. *Huang Nai*'s superior role became clear when even decisions made

at expert meetings were overruled, supposedly through his intervention.

An equally fierce discussion arose about the change from *xianxing mangwen* to *daidiao shuangpin*. Although the administration made it clear that "the decision" in support of *Huang Nai's* new system had already been made, it became obvious that opponents had not given up their opposition.

Several respondents said that suggestions for Chinese Character Braille systems had been discussed previously but had been put aside as had other suggestions mainly through the opposition of *Huang Nai*.

Little is known about the structure of decision making in Taiwan, but it can be assumed that those who have access to the printing facilities decide themselves which system they want to print and that the old system seems to have persisted almost unquestioned. Quite strong objections to the introduction of *daidiao shuangpin* have been voiced.

What will happen in Hong Kong is unclear but it can be assumed that sooner or later the Hong Kong system will be replaced by whatever mainland system is then in use. In the interviews in Hong Kong very little resistance has been voiced against this.

4.9 Critical reflections on the chosen methods.

The informal talks and interviews provided more insight than was expected since the respondents were very cooperative. Gaining access to the schools and being allowed to investigate integrated education in the countryside highlighted the need for good personal introductions. The apparent problem was the lack of available time. Staying at the schools and arranging many individual interviews required more time than was available. The interviews also did not make it possible to trace the process of decision making in respect of Chinese writing systems for visually impaired persons.

The method of taping a fully structured interview brought to light certain problems with regard to language and recording techniques. Nevertheless, it provided a means to work with a large number of this particular group of respondents and did provide some reliable data for statistical analysis. It has proven a very valuable means of investigation although having to conduct the interviews on an individual basis increases the required time enormously. For various reasons, such as not giving the respondent the feeling of answering under pressure, and the "boredom factor" of the researcher, an individual researcher should not do more than 10 interviews a day. Each taped question should always be read out fully and at the end of each question an audible marker should be recorded to indicate the end of the question.

The teaching of Prototype 1 Chinese Character Braille depended entirely on the cooperation of the respondents. This was given with great enthusiasm and is a statement in itself. Such experiments will be needed in the development of a future Chinese Character Braille system. As a means of encouraging responses and collecting suggestions it has proved invaluable. Nevertheless, especially in view of the time needed to learn such a system, respondents should not be "over experimented" on. Only when there is a very good chance that a reasonable system has been developed should a longitudinal study with a higher number of characters be attempted. Some respondents had learned *daidiao shuangpin* in an experimental phase and were quite disappointed that the effort they put into learning it was to this day not in any way justified.

4.10 Summary

The overall findings of the field work were that the attitude of the respondents towards the possibility of a Chinese Character Braille system are marked by the fact that there is a choice for visually impaired persons where there is no choice for the sighted. This makes it a highly controversial topic amongst users, aggravated by the fact that it would mean abandoning a relatively easy phonetic system in order to use a relatively more difficult character based system. This choice is highly personal and influenced by many variables, many of which this investigation could not identify. Nevertheless, it appeared that there might be a vicious circle at work linking the belief that one

cannot learn characters with the decision not to make an effort to learn them. Those respondents who want to learn characters do or have done this to some extent. Apart from this arguments both for and against a Chinese Character Braille system were voiced.

Despite the fact that the issue appeared to be very much one of individual choice decisions are made centrally and it became clear that on the mainland the central administration will object to a Chinese Character Braille system for the foreseeable future or for perhaps at least as long as *Huang Nai* objects to it. The administration appears content with the announcement of *daidiao shuangpin* in 1993 and its forthcoming introduction. This decision seems to stand despite the fact that only a small group of respondents appeared completely content with the existing system and the majority of users understood the problems created by the system and were in favour of changes which *daidiao shuangpin* could not fully provide for. The possibility of learning characters was not widely discussed. Instead the question of adding tonal representation to increase comprehensibility, i.e. the introduction of *daidiao shuangpin* was the main and very controversial issue on the mainland. *Daidiao shuangpin* was considered by many to be a wasted effort since it would not eliminate the main problems of Chinese Phonetic Braille but create a number of new ones. Although unification of Chinese writing systems for visually impaired persons has been regarded as important by many users it became clear that the unilateral introduction of *daidiao shuangpin* on the mainland has severely reduced the chances for this in the foreseeable future.

Compared to the individual choices of group 1, which seemed often to be based on opinions and beliefs, the objections of the administrators are mainly based on arguments relating to social circumstances. This could mean the administrators might change their view to one of acceptance once there is a change in social circumstances while for the respondents of group 1 it would need a change in their set of beliefs. It may be argued that social circumstances, as well as beliefs, will only significantly change if the writing system for visually impaired persons changes, which again would indicate a vicious circle at work.

Since the perception of characters is widely that of the characters for the sighted the introduction of Chinese Character Braille would require a change in perceptions of characters by users of writing systems for visually impaired persons. Such a change in perceptions was made without problem by the respondents who used Prototype 1 Chinese Character Braille system. The fact that respondents generally appreciated that knowledge of Chinese character script is very important in Chinese society, that a majority of respondents in group 1 think that they can learn them and want to learn them, would indicate that there is a group of respondents who would consider learning a Chinese Character Braille. On the other hand objection was found amongst respondents, who were all students, and is expected to be even stronger amongst other groups of braille users, such as, for example employees in "welfare factories".

The investigation has clearly shown that visually impaired persons who lost their sight before they received education for the sighted hold no coherent knowledge of Chinese characters. Although it became clear that they hold a patchy knowledge of different characteristics of characters it is obvious that such patchy knowledge would not be sufficient to use, for example, a computer input system for characters for the sighted, without prolonged education in characters and a computer input system. Chinese characters, however, are so far not taught at schools and any knowledge has been obtained circumstantially. This observation is of the utmost importance since it stands as proof that as long as visually impaired persons will not learn characters specifically they will not be able to use them, by whatever alternative provided.

Visually impaired persons who lost their sight later in life often still hold significant knowledge about characters but this knowledge cannot be creatively used and they therefore appear to lose this knowledge over time.

Education for partially sighted students to read large print characters has only just begun and therefore they too hold a limited knowledge of characters.

Despite the fact that the administration on the mainland has committed itself to a solution, albeit an inadequate one, by announcing the introduction of *daidiao shuangpin* it will be argued that the

introduction of a Chinese Character Braille system is needed. To achieve coherent knowledge of Chinese character script visually impaired persons have to learn Chinese characters and as a tool for this Chinese Character Braille would be appreciated at least by some. Since up to now such a code has not been widely discussed, and it may be assumed that a vicious circle prevents visually impaired persons from aspiring to learn Chinese characters, it appears imperative that a system should be introduced. This would make a wider discussion possible and might help to break the vicious circle for the individual and might also start changing the social reality on which the administration base their objections.

The question of choice as illustrated may become obsolete, should the state decide to fulfill its self-declared obligation to provide for equality. This would entail ending the self-regulation concerning writing systems of visually impaired persons in this respect and introducing, after sufficient research, a standard for the writing system for visually impaired persons which would match that of the sighted, thus creating the basis for equality.

Chapter 5 Chinese Character Braille Prototype 2

To conclude this study, a practical application in order to overcome the fundamental problem of Chinese character illiteracy of visually impaired persons will be attempted. This will henceforth be referred to as Chinese Character Braille Prototype 2, in short CCB2. In the creation of CCB2 the study takes into account the findings of the field work and the arguments raised during the preceding discussion. It would make little sense, at this stage, to develop a complete system covering tens of thousands of individual characters for the purpose of implementation in China. Not only will significantly more research be required to refine any suggestions, but the results of the field work and the sensitivity of the subject also indicate that it is essential to involve not only future users of the system but also decision-making bodies in China in this process. The aim is therefore to establish a framework and a set of defined terms according to which the necessary change to Chinese writing for visually impaired persons could be feasibly achieved in order to make Chinese character literacy of visually impaired persons possible. This framework is intended to be the basis for future research.

To illustrate the framework and to identify key issues 1000 characters were encoded, according to a set of specially established rules within the framework. It was considered that the coding of 1000 characters would be sufficient to make it possible to identify all major issues. The set of 1000 coded characters could, like the framework, form the basis for the intended future research. However, unlike the framework, the

choice of individual codes, although based on an array of carefully considered possibilities, is not based on any distinctive argument, and therefore has to be considered as arbitrary.

The chapter begins by introducing the concept of verbal identification of Chinese characters which forms part of the theoretical basis of the encoding system in CCB2. After this the underlying principles for the framework in CCB2 are explained. Then, the practical considerations of choosing the media for CCB2 are discussed. This is followed by an explanation of the set of rules employed to undertake the encoding of the characters and the choice of characters and choice of codes. At this point the argument for frequency is made since it strongly influences the actual choice of characters and the praxis of applying the framework. After this the praxis of applying the framework with four different representative groups of characters and the different strategies of creating the codes are laid out with examples. Once this is completed the system is discussed and compared to other existing systems.

5.1 Verbal identification

Since the direct tactile representation of Chinese characters has been ruled out as the basis for the creation of a writing system for visually impaired persons, a different approach to the one employed for the sighted had to be sought. This, however, also made it necessary to address the question of how a connection with characters for the sighted could be preserved in order to provide for easy communication

between visually impaired persons and sighted persons about individual Chinese characters. This essentially refers to the problem mentioned in the previous chapter (see page 136) on how to answer the question "Which *Li*?" when introducing a person with the family name *Li*. The concept tested and employed for this is a system of verbal identification.

The observer in China will notice a phenomenon that is almost unknown in countries which use alphabetic script. It might be compared to having words with identical sounds, homophones, spelled out if this is necessary for understanding. When Chinese-speaking persons talk to each other they quite frequently come across a syllable which one of the participants in the conversation is not able to connect to a character and therefore the person listening is not sure of the meaning of what has been said. This is not to be mistaken with not knowing the meaning of a whole word. Not being sure about one syllable might, however, obscure the understanding of a word. This situation appears to occur more frequently with names of persons or places. The context of a conversation usually carries the meaning of the other syllables when in question, but for various reasons, whether in poetry or with technical terms, it can happen that any syllable may not be understood. When observing such situations in China it also appears that this occurs more frequently when the persons in conversation are from different areas and are not very clear in their pronunciation of *putonghua*. It is only in such situations that sighted Chinese-speaking and character-literate persons are in the same

predicament as visually impaired persons, when they come across an unclear syllable in a Chinese Phonetic Braille text. If the sighted persons talking are not character literate then this cannot be overcome. If they are literate they have two possibilities to explain the character this syllable represents to the person they are talking to. The first one is to write the character down. If no pen and paper are to hand, or if this is simply inconvenient, it can be observed that one of the persons uses his/her finger to write an invisible Chinese character onto the hand of the other. Following the invisible pattern the other person is usually able to identify the Chinese character concerned, resolving the question about the unclear syllable. This option is of course not available to visually impaired persons.

The second possibility is to verbally explain which Chinese character is meant. To take up the example used in the last chapter, somebody with the family name *Li* (李) may be asked what *Li* that may be. One of the possible answers is "*muzili*" (木子李) which means *li* with the graphic component for tree and child, and describes the character for plum, a very common family name. The description "*muzili*" is unique for this particular character and appears to be commonly known and generally used to verbally identify this character. Descriptions for Chinese characters which explain the meaning of a character are also found in dictionaries but Verbal Identifiers (VIs) are not the same as the entries in character dictionaries like the *xinhua zidian*. VIs are colloquial, they do not necessarily convey the meaning of a character and they only identify a character in comparison to others with the same or similar

sound. Such verbal identification can of course also be used by visually impaired persons if they are character-literate. Verbal identifiers will therefore be considered in more depth as an option for both teaching of characters to visually impaired persons and Braille representation of characters. VIs will be defined as a set of verbal specifications added to the pronunciation of a Chinese character for the purpose of its identification.

Since no collection of VIs was known to the author, a small scale investigation was undertaken to establish a series of fundamental facts about them. 603 characters were given to 2 respondents. 569 characters were the 569 most commonly used characters, 34 of the characters were the 2053rd to the 2087th most commonly used (Guojia Yuyan Wenzi Gongzuo Weiyuanhui, 1992). Two Chinese respondents were chosen at random, one male one female, one from Shanghai and one from Nanjing, both sighted, well educated and currently resident in England. The respondents were asked to write down, in their own time and not in the presence of the researcher, how they would verbally describe each of the characters. The contradiction in this, to write down verbal identification, has been taken into account but was unavoidable due to lack of resources and the time voluntary respondents would spend on doing this. One of the respondents wrote down several VIs for each character while the other wrote down one VI for each.

It had been observed that VIs are very commonly used throughout China. The test has confirmed that character literate persons have no

problem identifying the most commonly used 600 Chinese characters by VIs. (see appendix B.I.) Since all the characters given in the test, including the ones which were much less commonly used, could be identified with VIs, it is expected that at least several thousand more characters will be distinguishable by this means. It became clear that each character has usually more than one VI and although most VIs may be known to character literate Chinese the choice as to which VI to use appears to some extent arbitrary. However, in about 50% of cases the two respondents gave identical or very similar VIs which would indicate a certain popular choice for some characters. Several forms of VIs could be identified. The most commonly used, in about 73% of cases, is using the character as a lexical compound, which means describing it by the word in which a character is used. In about 25% of cases comparatively less frequently used VIs are explanations. Explanations are counting for numbers, lexical phrases, giving examples by creating a context and combining characters of opposite meaning like "up", shang (上), and "down", xia (下) or "front", qian (前) and "back", hou (后) to identify either one of the used characters. In only 2% or fewer cases identifications based on the *Corpus* of the characters were used. In comparison this appears to be almost insignificant. The insignificance of *Corpus* based VIs compared to lexical compound based VIs is emphasised by the fact that they can, without any problem, be replaced by lexical compounds or explanations while *Corpus* based VIs cannot substitute for all the nominal compounds and explanations.

It is perhaps not surprising that *Corpus* based VIs are so rarely used since when compounds or explanations fail for whatever reason, the sighted can still retreat to the original *Corpus* by writing a Chinese character down.

The main significance of VIs could lie in offering the solution for the teaching of characters to visually impaired persons creating the vital link between knowledge of characters by sighted persons and visually impaired persons. However, VIs do not offer a complete solution for the representation of characters in codes for visually impaired persons since their use will have to be restricted by tight principles for the creation of codes. The results of the investigation into VIs do, however, indicate how knowledge of them can be used to delineate the underlying principles by which to create the codes.

In the following the framework in which CCB2 is to operate is discussed. The framework is designed for a system of individual codes covering approximately 7500 characters. The framework is not to significantly exceed the overall size of the *xianxing mangwen* Braille system, which is approximately on average between 2 and 2.5 cells per character, including space. This average is taken from an analysis of the examples given in the book about *xianxing mangwen*. *Daidiao shuangpin* would also be approximately 2.5, while *guoyu dianzi* is 3 cells per character. CCB2 is therefore not to exceed on average 3 cells per character, including space. The framework is also to provide for the system to operate according to existing reading patterns of

xianxing mangwen and make use of strategies for the creation of codes as suggested by the investigation of verbal identification and the creation of Chinese characters. The reasons for this will be explained.

5.2 Underlying principles of the system

It has been established in the preceding chapters that in order to enable visually impaired persons to learn Chinese characters and to further provide the possibility of reading and writing Chinese character script, each Chinese character has to be represented uniquely for visually impaired persons. The first principle therefore is that:

Each character will be represented by a unique code.

This principle has to be complied with under all circumstances.

The investigation into verbal representation of Chinese characters, however brief, has pointed strongly towards the possibility of representing characters with other means than just with their *Corpus*. It has also pointed towards the possibility of making the rules usually applied concerning the ordering of characters redundant. Thus a character was never explained for example according to how many strokes are used to create it. Account has been taken of the fact that the particular disability of Braille users means they hold little or no knowledge of the *Corpus* of the characters and of the fact that the principle of their currently used writing system is representation

through sound. In this instance special attention was paid to the possibility that the visually impaired user may remain with existing reading patterns. The second principle therefore is that:

> All codes are based on associations based on representation through sound.

This does not, however, rule out the possibility of making use of graphic components or other parts of the *Corpus* or the *Geist* of characters when encoding characters. It merely means that these parts will have to be represented through their sound. Basing any concept of encoding characters on sound has to be controversial in China, since one of the main features of a Chinese character is that it is independent of its pronunciation. The character or any of its compounds may be pronounced differently in different dialects. The concept has therefore to be supplemented with a code to bridge this gap when needed. For CCB2 a decimal code will be used. This will be employed especially for the purpose of ordering and can also be employed by any user who, like persons with a visual and a hearing impairment, cannot, or who like speakers of dialects, do not want to use association through sound. To base the code solely on representation of sounds is also a commitment to remain with existing reading patterns of Chinese Phonetic Braille and therefore also a commitment to reduce the workload when such a Chinese Character Braille has to be learned.

In the description of Chinese characters it has been pointed out that characters are created according to different strategies, traditionally called *liu shu*. This underlying principle of applying more than one strategy within one general concept to create characters, which in the case of characters for the sighted is the use of a set of strokes, will be employed. The third principle is therefore to:

> Use the existing concept of creating characters by applying more than one strategy within one general concept, in order to make the easiest possible association.

This approach should be clearly distinguished from approaches which place restrictions on the use of different strategies.

Analysis of frequency studies concerned with the use of Chinese characters has given clear proof of very strong differences in frequency between different characters. There is clear evidence that the size of a writing system for visually impaired persons could be significantly reduced when knowledge of this is employed. Proof of this will be produced when the current framework is implemented. The fourth principle therefore is to:

> Use units of different length employing the knowledge of frequency of use of characters, in order to reduce the overall size of the system.

The third principle of making good use of association and the fourth principle of employing knowledge of frequency, which means using smaller units for more frequent characters, will often conflict and in those instances reasonable compromises will have to be found.

5.3 Choice of medium

It has been pointed out previously that Braille is a convenient and internationally generally accepted medium for writing systems for visually impaired persons. For the purpose of encoding Chinese characters six-dot Braille and eight-dot Braille were considered. As has been pointed out earlier, there are other systems such as *Moon* but it did not seem appropriate to use them. Both six-dot Braille systems and eight-dot Braille systems are equally favoured by different users and developers. In Japan two different Chinese Character Braille systems have been developed, one using eight-dot Braille cells and one using six-dot Braille cells. In Korea a system which also uses six-dot Braille cells has been developed while in Hong Kong a system using eight-dot Braille cells is experimented with.

Six-dot Braille has 63 Braille cell forms compared to the 255 symbols of eight-dot Braille. The additional two dots increase the length of the eight-dot symbols compared to the six-dot cells and the distance between lines is also increased. Comparing the Perkins Brailler, a mechanical six-dot Braille typewriter, and the Elotype 02/8, an electronic eight-dot and six-dot printer, showed that eight-dot Braille has about 30% fewer cells per page. Despite the fact that, taking into

account frequency of use, a larger number of one cell units could be employed in a system using eight-dot Braille cells, an analysis showed that this would reduce the cell per unit average only slightly in favour of eight-dot Braille. Six-dot Braille can have an average of 2.7 to 2.8 cells per character unit while eight-dot Braille can have 2.4 to 2.5 cells per unit per character. The total difference in size, however, would lead to about 25% fewer character units per page when eight-dot Braille is used. Even assuming that another hardware solution could reduce the space between the lines it is most unlikely that in comparable circumstances eight-dot Braille will be a more space effective system for Chinese Braille compared to six-dot Braille.

The higher number of available Braille cell forms in eight-dot cells could and has been used as an argument that these might be employed in accordance with the ordering system for characters for the sighted. Having established, however, that the ordering system for characters for the sighted appears not to be what is mainly communicated there seems to be no adequate reason to depart from the six-dot Braille merely in order to comply with this particular ordering system. Such a departure would furthermore require major changes in existing hardware, which certainly in the foreseeable future is most unlikely. It can also be argued that the use of eight-dot Braille cell forms for the representation of writing rules out, or makes more difficult, their use in specialised systems such as computer codes, as for example ASCII, where eight-dot Braille appears to be highly efficient.

Six-dot Braille on the other hand is the existing system in all areas where Chinese Phonetic Braille is used. Using six-dot Braille would therefore enable users to remain with existing reading patterns.

Taking account of the above arguments, the medium chosen for the coding of Chinese characters for visually impaired persons, will therefore be six-dot Braille.

5.4 Rules for the creation of character codes

Before introducing the rules for the creation of character codes in detail, a short step by step guide is outlined below.

1.) Take a character, check its frequency of occurrence. The more frequently it occurs the more emphasis should be put on using a code with fewer cells.

2.) Think of a way in which the character could be described easily and which is commonly acceptable. Preference might be given to lexical compounds.

3.) Take the sound of this description and transfer it either identically or as similarly as possible into Braille cells as used in Chinese Phonetic Braille.

4.) Check whether this code has been used before, if yes, choose another code.

In the following the detailed description of how to create a Chinese character code for visually impaired persons and the points which will have to be taken into account will be given.

The strategy of following the principle of complying with existing reading patterns faces a problem when the Braille representation for sounds has to be chosen. As has been established the writing systems for visually impaired persons are different in the People's Republic, Taiwan and Hong Kong. In CCB2 the Braille cells are employed according to use of *xianxing mangwen*, the system used in the People's Republic. They can, however, be exchanged, if this is decided upon, without this decision drastically affecting the framework, although it would of course change all or most of the codes. In order to limit the likelyhood of any additional difficulties there is no additional meaning placed on the cells. For the representation of characters in a code the following characteristics of characters are employed:

- The *putonghua* pronunciation of a character
- its lexical compounds (by sound)
- its graphic components (by sound)
- others (by sound)
- logical combinations

Where possible the representation of characters is directly by their pronunciation or parts of their pronunciation. In the case of characters which have more than one pronunciation, only one of them is represented in the code. This is usually the pronunciation which occurs more frequently than the others. Exceptions are made when the

less frequent pronunciation is also less difficult to apply, for example in position No. 62 (得) *dei* for *de*. Characters which cannot be coded solely by their sound will be coded using a combination of sound and one of their other characteristics, from here on referred to as identifiers. For example, the character for "border" with the pronunciation *ji* (際) will be represented by a combination of its own sound and the sound of a commonly known lexical compound. In this case *guoji* (國 際). Instead of "*ji*" as in Chinese Phonetic Braille this character will read "*guoji*" in Chinese Character Braille. Identifiers are based on the sound or parts of the sound of the identifier. Only in very exceptional circumstances will no part of the sound of the represented character be part of the code. Identifiers have to be chosen according to availability but should also be chosen in order to provide the user with the best possible use of association. The codes are therefore generally based on either:

- part of the sound of the character,
- the full sound of a character,
- a combination of full sound of the character and full sound of the identifier,
- a combination of part of the sound of the character and full sound of the identifier,
- a combination of full sound of the character and part of the sound of the identifier,
- a combination of part of the sound of the character and part of the sound of the identifier.

Concerning the position of the identifier, it has been established in the investigation into VIs that to describe a character lexical compounds are used where the sound of the represented character is either in the first or second syllable. It would be desirable to fix the position of the sound of the represented character in order to make identification easier. Such a principle would, however, rule out many good combinations as for example in *guoji*, as seen above, and, in effect, would reduce the number of available combinations significantly. It is therefore argued that in cases where it is appropriate, the sound of the character to be represented may also be placed in cell two or three. According to this no rule is applied in CCB2 concerning the position of the identifier.

Using parts of the sound in the context of *xianxing mangwen* one has to distinguish between initials and finals and full initials and full finals in order to reduce ambiguity. Full initials and full finals are syllables which are represented by one cell Braille units: syllables like *shi*, *zhi* and *ying* and *wang*. Ordinary initials do not normally represent syllables on their own in one cell units. Such initials are for example: *b*, *p*, and *f*. Some full finals represent very few characters like *ong* which represents *weng*, or *ang* which, according to the *xinhua zidian*, only represents three characters. In addition to the rules of *xianxing mangwen* several rules are applied in CCB2, in order to specify further full initials and exeptions for full finals. *Xi*, *qi* and *ji* which in *xianxing mangwen* are represented by two cells, are turned into full initials, i.e. are represented by their initial only. A variety of full finals may also

be used as ordinary finals (see appendix B.III.), and the final "*eng*" is excluded from use in cell one, since it could be mistaken for the indicator for numbers. The *xinhua zidian* gives one character with the pronunciation "*eng*" (鞚), which will be treated as an exception.

The use of initials and finals for the representation of sounds will be restricted in order to reduce ambiguity. (see appendix B.III.a) These rules do not restrict the combination of cells but do restrict the meaning to which they are allocated. To give an example: the syllable *guan* is represented by two Braille cells. The initial on its own would read "*ji*" and the final on its own would read "*wan*". Therefore neither the initial nor the final can be used alone as a representation of its sound or as part of the representation for an identifier. Applying these rules means that for a number of syllables where both initial and final represent an individual sound, initial and final cannot be separated so that one of them can represent the syllable on its own. For example *guan* ("*ji*" and "*wan*"), jie ("*ji*" and "*ye*"), *shu* ("*shi*" and "*wu*") and *zhuo* ("*zhi*" and "*wo*") (see appendix B.III.b).

5.5 The argument for frequency

Making use of the knowledge of the frequency of the appearance of Chinese characters in texts has so far not made any sense in shortening the space used up by Chinese writing, since all Chinese characters are written in such a way that they use up the same space. Braille representations for characters could of course also be written in a way where they use up space equally. Taking into account that

Braille is a very large printing medium and that saving space is one of the major concerns, it is questionable whether such an approach is feasible in Braille. To clarify questions of frequency several studies were considered, two of which have been used. The *tongji biao* a frequency study by the Language and Writing Commission in Beijing (Guojia Yuyan Wenzi Gongzuoweiyuanhui, 1992) investigated the frequency of 7754 different characters compared to the 4574 characters of the *pinlü cidian*, a study by the Beijing Language Institute (Beijing Yuyan Xueyuan, 1986). The sample of the *tongji biao* includes almost 13 million characters compared to the not quite 2 million of the *pinlü cidian*. For that reason the *tongji biao* was chosen as the basis for the main analysis, while both studies were used for an initial comparison of results.

According to these frequency studies the following can be stated concerning the amount of text covered by the most frequent characters:

		tongji biao	*pinlü cidian*
10	characters:	12.33%	15.84%
52	characters:	28.98%	35.70%
1500	characters:	94.67%	95.94%
4574	characters:	99.83%	100.00
7754	characters:	100.00%	

This means that around 30% of a text could be represented with one cell six-dot Braille units, over 60% with two cell units and less then 10% with three cell units. It is therefore assumed, that using Braille units of different sizes, taking into account frequency, can

significantly reduce the overall size of the system compared to a system using units of identical size. This will be shown to be correct through implementation, which will reveal, however, that practical difficulties will affect those percentages unfavourably.

Percentage results of such frequency studies are of course not absolute constant figures, they will vary to some extent in every given text. They do, however, indicate to a reasonable extent what can be expected, and with the exercise of due caution are used throughout this study.

Choice of coded characters

Altogether 1000 characters were encoded. The choice of characters was made according to four principles in order to provide illustration for frequency of one and two cell units and the combinations of sound and identifiers in two and three cell units.

The first principle was that all 52 one-cell-units were allocated.
The second principle was that as many as possible of the theoretically 413 units already in existence were to be allocated. Existing units are units which directly represent a syllable in *putonghua* according to the use of *xianxing mangwen*. 27 one cell units already existing and 379 two cell units already existing were allocated. For seven units already in existence no characters were available in the list to be represented. To comply fully, however, several units for existing syllables had to be changed or newly created.

The third principle was that all 126 units representing characters with the pronunciation "*ji*" were to be allocated. Also all 95 units representing characters with the pronunciation "*fu*" were to be allocated.

The fourth principle was to allocate the most frequent 680 characters. Amongst those 680 characters as many two cell units as possible were allocated. These 680 characters, according to frequency, cover already approximately 82.3% of a text. Altogether 657 two cell units were allocated. The remaining 291 characters were allocated three cell units. The whole set of coded characters covers approximately 85% of texts.

Finally 19 characters were coded in order to have available all characters to produce, in CCB2, the same texts as used in the field-work experiments.

5.6 The choice of codes and practical implementation

As far as possible lexical compounds and explanations were taken from dictionaries such as the *xiandai hanyu cidian* (現代漢語詞典), the *cihai* (辭海), the *hanyu dacidian* (漢語大詞典) and the *zhongwen dacidian* (中文大辭典). The choice was based on some common knowledge but was primarily concerned with availability and the reduction of ambiguity. For the 500 most frequent characters results of a test into verbal identification were also taken into consideration. However, while the four basic rules of the framework and the choice of medium are based on reason, the choice of codes was essentially arbitrary and all individual codes are therefore fully open to changes.

Practical implementation

In the following the practical implementation of the framework is illustrated step by step with examples. The characters to be coded were chosen according to the above mentioned principles from the *tongji biao* frequency study. First the codes are explained according to their size and after that the rules for the use of identifiers are illustrated. Following this the result of coding all characters with the pronunciation "*ji*" and "*fu*" is discussed. A list of the encoded characters and their codes as well as the associations the individual codes are based on is to be found in the appendix. (see appendix B.II.)

In the following the ASCII codes of the Braille units are written between two hyphens, for example -ba-. A conversion list is to be found in the appendix (see appendix B.IV.)

One cell units

The first units to be chosen were the one cell units. The one cell units have been chosen to represent certain characters since their sound is either identical or similar to the characters they represent. 27 characters were allocated to characters in accordance with existing units. An example of identical sound is the character in position No. 2 *yi* (一) which is represented by the one cell unit -i- which on its own reads "*yi*". An example for representation through a similar sound is the most frequent character pronounced *de* (的) which is represented by the one cell unit -d- which on its own reads "*d*". The characters

have been chosen since they occur in texts very frequently and/or since they could be represented by a one cell unit identically. The first 15 chosen characters represented with one cell units are the 15 most frequently used characters. The last chosen character represented by a one cell unit in the *tongji biao* comes from position No. 464 with the pronunciation *wang* (王) which reads "*wang*". According to frequency of occurrence the 52 chosen characters average 24.4% of a text according to the *tongji biao* and 28.1% according to the *pinlü cidian*. (see appendix B.II.1) It appears safe to assume that in modern Chinese texts they will average roughly 25% of a text. In the *tongji biao* 30 characters are amongst the 52 most common, while 26 are amongst the 52 most common in the *pinlü cidian*. A strict application, entailing the representation of only the most commonly used 52 characters, would have resulted in figures of 28.8% of texts or 35.7% respectively. This does not take into account that not all the characters in the two lists are identical. For the remaining analysis only results of the *tongji biao* are used.

Two cell units

The first principle of creating two cell units is to use the existing units representing the syllables of *putonghua* as represented in *xianxing mangwen*, or if they have already been represented by one cell units to create units of identical sound. According to frequency, such units represent about 30% of texts. (see appendix B.II.2) An existing two cell unit could stand for the syllable *cheng* which in position No. 34 (成) represents the character with the pronunciation "*cheng*". An example of a unit which has already been represented by a one cell unit would be in position No. 64 (十), where a character with the pronunciation "*shi*" is represented by -5i-, which reads "*shi i*". One of the units, in position No. 4941 (咯) "*lo*" was coded as a three cell unit -l??- which read "*lo e*", since in *xianxing mangwen* there would have been ambiguity with "*le*".

To ensure that the overall size of the system is kept small it was decided to code as many frequently occurring characters as feasible with two cell units. As many as possible of them should be amongst the 500 most frequently occurring characters. In CCB2 about 400 two cell units are amongst the first 500. 200 of them are newly created 2 cell units.

Altogether there have to be at least about 500 newly created two cell units to comply with the aim of staying on an average of well below 3 cells per unit. 287 of them have already been coded.

There are 2704 possible two cell units available for coding although certain combinations of initials and finals should be avoided. The final "*ün*" for example should not be used after the initials "*b*", "*l*", "*k*", since it creates a space. This is because in the Braille cells for b, l and k all dots are on the left side of the cell while in the Braille cell for the final "*yun*" all dots are on the right hand side. It has therefore to be considered whether "*qun*", which in *xianxing mangwen* is a combination of "*k*" and "*yun*" should be created that way. The use of the initials "*b*", "*l*", and "*k*", after the final "*ün*" should also be avoided since this could create the impression of a different cell with six dots. However, since "*qun*" is a unit already in existence it has been applied while the creation of other such units was avoided.

The use of two cell units to represent characters with parts of sounds of characters or parts of the sound of indicators is also restricted according to the above mentioned rules concerning full initials and full finals. Generally speaking, in CCB2, three cell units were automatically applied to syllables which when represented through part of their sound create ambiguity. However, with the first hundred of those, which according to their frequency represent 6%-7% of a text, exceptional rules were employed. In CCB2 there are several exceptions which are pointed out in the practical implementation.

According to their frequency the two cell units coded in CCB2 make up about 50%-55% of texts. This number can be increased by up to 5% if more exceptions amongst the most frequent 500-600 characters are

employed. In the following, different combinations for two cell units are explained with examples.

Combinations of full initials and full finals make it possible to write lexical compounds in two cell units. Since they are highly effective in reducing ambiguity all available units should be used and these combinations should only be used when actually representing two full characters. Provision for the latter has already been made with the above mentioned rules concerning full initials and full finals. An example of a combination of two full initials is No. 162 where the reading "*zhishi*" (只是), is used to describe a character pronounced *shi* (是). In this example the sound of the represented character is in cell two. It can of course also be in cell one as, for example, in position No. 599 where a character with the pronunciation *zhi* (致) is represented with a two cell unit which reads "*zhici*" (致辭). In both cases they read exactly like lexical compounds which are closely related to the character represented.

Two examples of the combination of two finals are No. 467 "*yangyu*" (養育) to describe *yang* (養) and No. 477 "*yuyang*" (育秧) to describe *yu* (育). In these two examples the sound of the character represented is placed in cell one. Combinations of finals followed by initials are of course also possible as, for example, in No. 111 where the reading "*youci*" (由此) is used to describe *you* (由) or in position No. 282 where "*wuqi*" (武器) is used to describe *qi* (器). Combinations of initials followed by finals are only possible if they do not create an

already existing syllable. Examples for this are found in position No. 185 where "*zhiyan*" (直言) represents *yan* (言) and position No. 333 where "*zhiyu*" (至于) represents *zhi* (至). Where a combination of an initial followed by a final is highly desirable but not possible since it has been used by existing units as, for example, with "*jiyan*" which reads "*jian*", three cell units have to be applied.

52 units are made up of doubles. Doubles are when two identical cells are used together in one unit. These will be employed when appropreate, for example, when representing an identical sound or when units are otherwise very difficult to be employed. An example for identical sound is found in No. 18 *yi* (以). "*Yi*" has already been represented by a one cell unit in No 2 (一). In position No. 74 *li* (力) the initial "*l*" is doubled since it can also be explained as a code for "*liliang*" (力量).

In the following combinations of full initials and full finals with ordinary initials and finals are presented. There are twelve basic combinations available.

Full initial and ordinary initial can be combined with either of them being in cell one. For example, when in position No. 97 the character with the pronunciation *dian* (點) is represented through the association with its lexical compound "*dianzi*" (點子). This lexical compound is represented with part of the initial sound of "*dian*" "*d*" in cell one and the full sound for "*ci*" in cell two. It therefore reads as "*d ci*". In position No. 112 the character with the pronunciation *qi* (其) is

represented via the association with its lexical compound "*qita*" (其他). In cell one the full sound of the character is placed as "*qi*" while only part of the identifier "t" is placed in cell two. It therefore reads "*qi* t".

There are very few units with a full initial in cell one and an ordinary final in cell two, except in already existing units. One of the very few examples is found in position No. 203 where the character with the pronunciation *shi* (式) is represented with its sound in full in cell one and a reference to one of its graphic components "*gong*" (工) used through part of its sound "*ong*" in cell two. It therefore reads "*shi ong*". It can also read "*shi weng*" although "*ong*" is treated as an exception. An example for an ordinary final in cell one and the full initial in cell two is found in position No. 634, where the character with the pronunciation *gong* (功) is represented through association with its lexical compound "*gongji*" (功績). Part of the sound of the identifier "*ong*" is placed in cell one while "*ji*" is in cell two. It therefore reads "*ong ji*".

Examples of combinations of full final and ordinary initial are found in position No. 182 where the character with pronunciation *tong* (通) is represented through association with its lexical compound "*tongyong*" (通用) and in position No. 338 where the character with the pronunciation *yi* (議) is represented through its lexical compound "*yilun*" (議論). The code for No. 182 reads "*t yong*" and the code for No. 338 reads "*yi l*".

Along these lines there are combinations of full finals and ordinary finals with examples found in position No. 521 "*shenyi*" (神异) for *shen* (神) which reads "*en yi*" and in position No. 495 "*yingong*" (引 弓) for *yin* (引) which reads "*yin ong*". Also combinations of ordinary initials as, for example, in position No. 186 "*timu*" (題目) for *ti* (題) which reads "*t m*", combinations of ordinary finals as in position No. 351 "*gongchang zhang*" (弓長張) for *zhang* (張) which reads "*ang ong*", and combinations of ordinary initials and ordinary finals as in position No. 415 "*bangong*" (辦公) for *ban* (辦) which reads "*b ong*" and position No. 444 "*haoma*" (號碼) for *hao* (號) which reads "*ao m*".

The two main concerns when applying these combinations have to be on the one hand to create as many two cell units for the most frequent characters as possible, making best use of possibilities for association while being as strict as possible concerning the reduction of ambiguity. It is these combinations that will certainly each have to stand the test of future users. CCB2 could of course have been created attempting to create a minimum of ambiguity, i.e. use only 27 one cell units, about 400 two cell units and encode the rest with three and four cell units. Although this would have resulted in a higher cell per units average, it might be completely appropriate. This study has however undertaken to point out both the possibilities and problems of keeping the system as short as feasible.

To reduce the number of three cell units amongst the most frequent characters and for exceptional use some additional strategies are

employed. One strategy in CCB2 is the use of tonal representation 1, -a-, in cell one followed by a sound referring to the represented character. An example of this is found in position No. 103 a character pronounced *xing* (性). The syllable *xing* is one of those which cannot be represented in parts according to the given rules and should therefore be represented in a three cell unit. As a frequently occurring character it is, however, desirable that it be represented as a two cell unit. It was therefore encoded using the strategy of employing tonal representation one in cell one. It then reads "*tonal representation one xi*".

This strategy was also employed to represent the less frequent full initials and finals which had as single cell units been employed to represent double cell units, for example position No. 6547 for the character with the pronunciation *m* (母). Initial "*m*" on its own had already been employed so using tonal representation one the character was coded reading "*tonal representation one m*". There is a whole series of possibilities concerning the use of additional cells to reduce the number of codes with three cell units amongst the most frequent characters. It could involve tonal representation one in cell two, other tonal representations or the colon stroke in cell one or two. While it is important to introduce such possibilities in this study, these are, however, not discussed any further here, since future research is needed to decide what an appropriate use of them would be.

Three cell units

Three cell units are used when two cell units are not applicable or available. They are generally used for the less and least frequently used characters. Compared to the newly created two cell units they often reveal the full pronunciation of the represented character and should therefore be easier to learn. This should to some extent balance the fact that they are less frequently used and therefore more easily forgotten.

Three cell units are generally made up of the whole sound of the character represented. This can be in either one or two cells. The syllable can be placed in front of or after the identifier. The identifier can be one or two cells depending on the size of the represented sound. In theory, this provides 104 combinations to choose from when the sound of the represented character is in two cells and in theory over 800 possibilities when it is in one cell. There can, however, also be instances when the sound of the represented character will only be partly represented which then also results in over 800 possibilities of representation.

To see how many characters are represented by each syllable a list was created where the number of characters represented with each syllable amongst the most frequent 7754 characters was established (See appendix B.II.3). Only very few syllables present a problem but this should be taken into account when using them as identifiers. While the full initials and full finals are easier to deal with, characters with

the pronunciation *jiao*, *jian*, *jie*, *xian* and *zhu* and so on, might prove rather difficult to code. The investigation shows, however, that the rules employed are sufficient to make the encoding of 7500 characters possible.

In the following, examples are given about how to create the codes for three cell units.

Full sound (initial and final) in cell one and two and full initial in cell three or full initial in cell one and full sound in cell two and three. They are found for example in position No. 193 "*xiangqi*" (象棋) for *xiang* (象) which reads "*xiang qi*" and in position No. 412 "*jishu*" (技术) for *ji* (技) which reads "*ji shu*".

Full sound (initial and final) in cell one and two and full final in cell three or vice versa are found for example in position No. 318 "*jiaoyu*" (教育) for *jiao* (教) which reads "*jiao yu*" and in position No. 614 "*yunshu*" (運輸) for *shu* (輸) which reads "*yun shu*".

Full sound (initial and final) in cell one and two and ordinary initial in cell three or vice versa are found for example in position No. 180 "*xiangfa*" (想法) for *xiang* (想) which reads "*xiang f*" and in position No. 445 "*bilü*" (比率) for *lü* (率) which reads "*b lü*".

Full sound (initial and final) in cell one and two and ordinary final in cell three or vice versa are found for example in position No. 224.

"*jieshou*" (接受) for *jie* (接) which reads "*jie ou*" and in position No. 2827 "*fenfu*" (吩咐) for *fu* (咐) which reads "*en fu*".

There are, however, whenever necessary a variety of further combinations, although most of them have not yet been used. Some possible examples will be given. Triplets, units which are made up of three identical cells, which can be combinations of three full initials or three full finals as, for example, "*shishishi*" or "*yangyangyang*". Other combinations of three full initials or three full finals as, for example, "*shizhici*" or "*yinyangyun*" can be used. Three ordinary initials or three ordinary finals, as for example, "*bbb*" or "*ou'ou'ou*" can of course also be used but might be reserved for characters which present particular difficulties.

Of course any other combination of initials and finals either full or ordinary is available although only one example has so far been coded in position No. 7219 "*fu shiqi*" (簠食器) for *fu* (簠) which reads "*f shi qi*".

Over 7500 characters.

There are at least two approaches to cover characters after the set of the most frequently used 7500 under the current framework. One is to make use of previously unused three cell units taking the risk that the reading of these units might become increasingly confusing. Three cell units, however, provide for sufficient codes. The other approach is to start using 4 cell units making available indicators which are fully represented or even use two indicators. This significantly improves the number of available units which provide the full reading of the characters. The possibility of leaving the framework of CCB2 for another approach can also be taken into consideration especially since the pronunciation of the least frequently used characters is often not an important consideration. One possibility for a separate framework for extremely rare characters would be to use cell one as the indicator to flag that a rarely used character is coming up. The colon stroke could be such an indicator. Following this a decimal system equal to the one used for ordering the above could be employed. This would make available another 2704 three cell units and over 140,000 four cell units. Employing the indicator system would make it possible to consider a separate use of four cell units, bearing in mind the feasibility of a future shorthand Chinese character Braille.

Rules for the use of identifiers

In the following the rules for the creation of CCB2 units with identifiers and use of identifiers is discussed.

Lexical compounds

As the brief investigation into verbal identification has shown, most of the identification of characters is not through reference to the *Corpus* of a character but through association with its lexical compounds. In Position No. 124, the character with the pronunciation *shi* (事) is explained through the word "*shiye*" (事業) in which it is commonly used. The use of lexical compounds with or without tones can, however, also be a source of ambiguity. This has to be addressed when a code is finally to be chosen. Lexical compounds are readily available for most of the commonly used characters but become fewer amongst the less and least used characters.

Explanations

The term explanations is used in this context as follows: in explanations different strategies are employed which may help the user to identify the character through wider association. In position No. 406 *jin* (進)the character for near, the sound "*jin*" is followed by the sound "*yuan*" which can stand for far, therefore it reads "*jinyuan*" (進遠). This method is employed frequently in Chinese language and such combinations sometimes have even become lexical compounds. Explanations can be used for both syllables as shown in position No. 550 where the code is simply reversed. Another example is No. 408 *qian* (千) standing for "thousand", which is followed by "*wan*", which can stand for "ten thousand". No 408 therefore reads "*qianwan*" (千万). Explanations are strategies which usually rely on the meaning of the character to be represented.

Graphic components

Graphic components are parts of the *Corpus* of a character used as an ordering principle. According to the principle of using sound as the basis, graphic components when used as identifiers are represented through their sound or parts of their sound. The graphic component representing "heart" for example would have to be represented with its pronunciation *xin* (心). When appropriate the more colloquial version of the verbal description should be used. For example the graphic components , *yi* (邑) as in district center, *fu* (阜) as in hillock, and *jie* (卩) as in seal are commonly known as left ear, right ear and small ear, and can, therefore, be represented as "*er*" (耳) for ear. (see appendix B.II.4)

Some graphic components can be represented with full initials or full finals in one cell as, for example, "*yi*" as for number one (一), -i-, or the above mentioned "*er*" as for ear (耳), -r-. They are, therefore, quite easy to employ, as in position No. 64 "*shi and yi*" (十 一) for *shi* (十) which reads "*shi yi*" and in position No. 267 "*ji and er*" (即 耳) for *ji* (即) which reads "*ji er*".

Graphic components which have a pronunciation where the initial and final are not to be separated (see page 174-175), can only be employed when the representation of the sound of the character is in one cell. "*Xin*" as in heart, for example, cannot be separated and will only be used in two cells as it is for example in position No. 6823.

Lexical phrases

A further possibility for using ways of association as reference to Chinese characters is citing well known quotations, idioms or classical references. This is a possibility especially with characters where no appropriate lexical compound and no appropriate graphic component is available which will more often be the case where the characters are less frequent and where more characters have already been coded. Two early examples, however, are in position No. 292 "*sierhouxing*" (思而后行) for *si* (思) which reads "*si er*" and in positions No. 389 "*chizhiyiheng*" (持之以恒) for *chi* (持) which reads "*chi zhi*". A very well known idiom is represented in position No. 3732 ji (驥), which reads "*lao ji*" and refers to the proverbial old horse in the stable (老驥伏櫪,志在千里).

Logic

The code in position No. 147 "*youyou*" (又又) for *you* (又) which reads "*you you*" is probably the best example of a logical way to create a code. The represented character has the pronunciation "*you*" in a single cell and the general meaning of the character is an indication of a "repetition". In this case the single cell "*you*" is simply repeated creating a double cell unit conveying both the sound and the meaning of the character.

Combination

Combinations could become important with the least frequently occurring characters which may be used very rarely but with very much the same meaning as a commonly used character. In this instance it is possible to use the code of the commonly used character plus an identifier, as long as this does not create extra ambiguity. An example of this is found in position No. 5412 *ji* (忣). In this case one cell is changed in the the code -gpo- for No 805 *ji* (急). The code for 5412 can then read "*ji p e*", -gp?-. The combination was chosen since according to the *xiandai hanyu cidian* the meaning of the character in position 5412 *ji* (忣) is similar to the character in No 805 *ji* (急).

Exceptions

There are some characters where it may be strongly advisable to make exceptions to the standard rules. One, for example, is *guo* (國) as in country. This character, one of the most frequently occurring in this list, is found in position No. 16. It should, therefore, under no circumstances be represented by a three cell unit. In position No. 46 is a character also pronounced as guo. It too should not be a three cell unit. Thus it becomes clear that an exception should be made. In this case a combination of a full final which represents both the sound and the character of "my", *wo* (我) and the initial for country, *guo* (國) is used. This just turns around the usual combination of initial and final and refers to a very common lexical compound of "*guo*", "*woguo*" (我國) - my country. It breaks the rule of not using the full initial *ji* other than for *ji*, but in this instance this seems quite appropriate.

Another possible area for exceptions is the use of very similar sounds as for example in position No. 68 "*zhene*" (著呢) for *zhe* (著) which reads "*zhi n*" and in position No. 371 "*jizhe*" (記者) for *ji* (記) which reads "*ji zhi*".

Other principles of creation

No strategy of creation should be ruled out as long as it can work within the given framework. One other strategy is simply a combination of available sounds. Two examples of this are found in position No. 511 "*err*" for *er* (爾) which reads "*er r*" and in position No. 2514 "*youou*" for *yo* (喲) which reads "*you ou*".

Bias of the encoder

The individuals or the group which will finally be responsible for the encoding have to judge not only what is considered the best association for a character but also how these associations may be chosen. One example of this is the question of how colloquial an association may be. As one exceptional code may illustrate, there will have to be a discussion concerned with ethical or moral issues or simply with issues of "good taste". In position No. 246 *fang* (放) has been coded with the association "*fang pi*" (放屁), to pass wind. This is merely to illustrate, however, the problems of bias on the part of the encoder or encoders. Bias will occur through variations in local use of language, through educational background and so forth and has to be addressed.

Ji unit and *fu* unit

To illustrate the possibilities and problems when encoding characters with very common pronunciation all the 128 characters of the list with the pronunciation *ji* and the 96 characters of the list with the pronunciation *fu* have been encoded in addition to those already encoded amongst the most frequent 680 characters. As has been pointed out there are several different kinds of two cell and three cell units. The first difference depends on whether the pronunciation of the character coded is represented by one cell or two cells. This was the reason to code not only all characters with the pronunciations "*ji*" which is represented by one cell but also all characters with the pronunciations "*fu*" which is represented by two units. It was expected that *ji* and *fu* can illustrate a number of practical problems of encoding since they represent a very high number of characters.

The units were created according to all of the principles stated above, except for the fact that combinations of *ji* as initial with full finals are already all occupied in units representing existing syllables. Examples of the codes can be found in the list.

The analysis of creating codes for "*fu*-units" and "*ji*-units" brought several problems to light. The first apparent problem is the shortage of available units which is aggravated where more characters are represented by one syllable. Shortage means that a code which would be desirable may not be used. This can have several reasons. One is

that units are not available according to the above-mentioned rules in order to avoid ambiguity. To give an example, "*fuchu*" cannot be represented with the full syllable "*fu*" and the initial for "*chu*" since this would read "*fu chi*". "*fuchu*" could, however, be represented by a code which reads "*f chu*". A further reason is often that the unit with this code has already been allocated. Although compromises can be found there will always be cases when one code might be appropriate for two characters, but can only be employed once.

An additional problem which has already been mentioned above arises mainly with the least frequently occurring characters which are either monosyllabic or which only appear in one particular lexical compound. The desirable codes for these characters are therefore often very restricted. If characters appear only in one combination both characters in this combination might have the same desirable code.

Sometimes there is a desirable code but it might cause ambiguity since the code could also stand for something else which is much more commonly used as, for example, in position No. 5816 "*banji*" (斑鯚) for *ji* (鯚) which reads "*banji*" which stands for a certain type of speckled fish but could also read "schoolclass" *banji* (班級) or "regular plane" *banji* (班機). It would therefore be desirable to choose another unit, but it might not be possible to find another desirable one since, as mentioned above, there might be a shortage.

Shortage in this instance is created since the syllable *ji* stands for a whole variety of fishes. This reduces the possibility of employing graphic components like *yu* (魚) for fish which at best can be employed a few times as for example in *jiyu*, *yuji*, *jiyuyu*, *yujiyu*, *yuyuji*. This does not even take into account that *yu* is also a syllable with a very high number of characters represented by it. To illustrate further difficulties: The above example does not take into account that *jiyu* would have to be a three cell unit, since as a two cell unit it would read "*ju*". *Jiyuyu* etc. would have to be treated as exceptions. Even other associations like sea, *hai* (海) or river, *he* (河) might sometimes no longer be available.

The less frequently occurring characters are more likely to be *danzi* (單字), characters which do not appear in lexical compounds at all. These are difficult to classify under CCB2 and when none of the coding principles can be applied, arbitrary use of the identifier has to be undertaken.

A further problem is whether or not to follow simplifications which have been introduced in the past. An example of this is that the character in position No. 6013 () is usually represented by the character in position No. 1338 (續). If the character is to be coded it might be difficult to find a unit which distinguishes it from its short form while still maintaining a reasonable association. It would however be easy to employ one cell to indicate long-forms of short-forms, where this appears appropriate.

The possibility of introducing self-made simplification as, for example, in position No. 5301 *ji* (佶) and position No. 5815 *ji* (詰) should be taken into consideration, although such decisions would have to be recorded in dictionaries, as they are indeed in dictionaries for the sighted. For the codes of CCB2 the official coding has been followed, which means simplifications are used when they are officially approved and no self-made simplifications are used.

Despite all the problems identified and a good chance that implementing the system for all 7500 characters might establish some more and despite restrictions on the use of units and a shortage resulting from this, it became clear that the high number of units to choose from provides for the possibility in the vast majority of cases of creating units where reasonable association appears feasible. It also showed that the majority of difficult allocations would mainly appear amongst the least frequently occurring characters.

Ordering systems

The cells of the system are ordered in a numerical system (See appendix B.V.). Characters are represented using units of 2 digits, 4 digits and 6 digits. To give a few examples for two digit units:
The character *bu* (不) is represented with the code -b-. In CCB2, -b- has the digital number 01, *bu* (不) can therefore also be read as 01. The character *yong* (用) is represented with the code -4-, which in CCB2 has the digital number 52.

Four digit units:

The character *bu* (部) is represented with the code -bu-, which in CCB2 has the digital number 0122 (b=01 and u=22).

Six digit units:

The character *guo* (果) is represented with the code -gom-, which in CCB2 has the digital number 092003 (g=09 and o=20 and m=03).

The digit code will to some extent also represent the frequency of characters, in as far as units of two and four digits occur more frequently than units of six digits. Digital order in CCB2 has one cell units first, followed by two cell units and finally three cell units.

5.7 Discussion of the system

Using CCB2 a computerised work place for visually impaired users is perfectly possible. The user can process any digitalised text in Chinese characters. Output for the visual impaired user would be in Braille hard and soft copy, while for the sighted person screen or ink print output is available. Input of the visually impaired user would be by chording as on the Braille typewriter. Although scanning of Chinese characters is not yet perfect it could also be used.

There is no objectively overall best way to represent Chinese characters for visually impaired persons. Certain characteristics such as size of the units and relationship to existing reading patterns can be measured in different approaches. The combination of characteristics as well as the choice of fundamental principles has to be one which is

essentially left to the users of the system. CCB2 is a system which provides a series of possibilities, leaving open the option for future compromises. It is based on assumptions which have been argued for above, but which can understandably also be argued against. Since collecting the opinions concerning the choice of future users has to be part of future research what remains here is to try to collect the critical arguments and to attempt to measure CCB2 against existing alternatives and also against some possible alternatives which do not yet exist.

The main source of concern has to be the choice of basing the system on sound.

Users of *putonghua* based systems other than the one implemented will have to learn what is for them a new set of representations, but can still apply their language as a basis for the use of character Braille. However, CCB2 provides the user in the People's Republic of China with the possibility of remaining with existing reading patterns and makes full use of existing knowledge of characters.

Users of Cantonese Braille will be affected by this more strongly since they will have to choose between using the decimal ordering system of the character codes or learn *putonghua*. Users of characters outside China will equally have to make such a choice. Characters for the sighted are not based on sound and enable anybody, regardless of whether or not they speak a certain dialect, to use them. CCB2 also

provides for this since it can also be used according to a system of decimal ordering which can be used as an alternative to the association through sound.

It has been argued before that a system based on the sounds of any one dialect represents a handicap for all those who do not grow up with this dialect as their main form of communication. While this remains correct and is a shortcoming which has not been rectified in CCB2, any artificial combination of Braille cells not based on sound to create a Chinese Character Braille code, such as the one suggested in Korea for example, could be an even bigger disadvantage. The only difference with such a system is that it would be equally disadvantageous for everyone. Equality with the sighted has been achieved by coding each character. The question remains whether equality amongst users from different areas should mean that the code must be equally difficult for everybody, or whether some may find it easier than others.

This system is completely new to any user and would therefore be very difficult to implement. However, this would also be the case for any other new system which could be a non-sound based alternative.

It is unclear how the units will be recognised by readers. However, any system can of course provide for users who recognize the whole unit rather then its parts. In any system, such use would supposedly be related to frequency of use. Frequently used two cell or three cell

units may in time not be identified by their individual parts but as a whole unit. By taking account of frequency when deciding the size of a unit the system encourages to some extent the possibility of such use, especially for two cell units. Generally speaking, however, the system is based on an approach where units are recognised as a combination of its parts.

Once the code has been learned for a character the different meanings and the different pronunciations of a character have also to be learned. This means teaching for visually impaired students on a similar level to sighted students including a "character learning class". This additional learning is not only necessary to enable better reading and writing but is necessary in order to improve the cultural knowledge of students. This includes knowledge about the use of characters in literature, etymology of characters and so forth.

To employ knowledge of frequency has proved highly effective. It not only reduces the overall size of the system, it also addresses the factor that the most frequently used characters might be more easily remembered. To have the more explanatory units representing less frequently occurring characters seems appropriate. This again is less important with the least frequent characters where the user may use a dictionary in any case. Assuming that a space is placed between each character the following percentage division has to be observed to remain on average under three cells per character including space: One cell units 25%, two cell units 55% and three cell units 20% of a text.

CCB2 compromises the argument of frequency to the limit in favour of easy cognition but still achieves a percentage below 3 cells per unit.

Although CCB2 already constitutes a short hand form it would seem important to consider a further reduction of the number of cells per character. Different suggestions for this can be taken into consideration once all character codes are assigned and approved. One possibility for a reduction of spaces would be to employ units which refer to more than one character, a system which may be referred to as word writing. Such options have to be discussed most thoroughly since they pose the danger of again separating the writing of visually impaired persons from the writing of sighted persons.

One main source of ambiguity in CCB2 is the double use of the cells for "*k*" and "*q*" etc. CCB2 has accepted this double use and made provisions for it. There would of course also be a possibility of trying to eliminate this problem by eliminating the double use of these cells. Whether or not the final system should be based on *xianxing mangwen* as in CCB2 or on any other or adapted system remains essentially the choice of future users.

In the following comparisons with existing systems are made.

Computer input systems

None of the computer input systems for Chinese character script have so far been translated properly into Braille cells. However, none of the *Corpus* based systems seem to be of much assistance to visually impaired users, taking into account the findings about verbal identification and the existing knowledge about Chinese characters held by visually impaired persons. Systems which are solely based on the pronunciation of a character and then offer a choice of characters with such a pronunciation from the screen are in practice also *Corpus* based systems, since the final identification of a character is through its *Corpus*. One attempt in Hong Kong to adapt to such systems was to translate the symbols of the ASCII code of the Chinese characters into eight-dot Braille cell forms. This was undertaken in order to provide the necessary identification through Braille-output of the ASCII code, instead of from the screen. It remains essentially an adapted input system with significant shortcomings for the visually impaired user. To use the eight-dot Braille cell ASCII coding of Chinese characters as a proper Braille writing system appears to be not at all applicable, since it appears to be extremely difficult to learn. There are practically no means of association between the code and the represented character in this system. The arguments against an eight-dot Braille system would remain.

Computer input systems for Chinese characters based on association (*lianxiangma*), which are to some extent comparable to verbal identification, have been adapted with voice output describing through

lexical compounds the available choice of characters on the screen. Such an adaptation remains futile since visually impaired users still have to learn the characters and to learn them they need useful representations of them in Braille. When choosing useful representations it is an advantage for visually impaired users to concentrate on their own needs, on hardware solutions for visually impaired persons, and therefore to concentrate on a system which has useful characteristics for Braille users, such as the above-mentioned chording. Once the characters have been coded in Braille, visually impaired users have a highly effective input system and it is unlikely that they would actually return to any input system for sighted persons. Adaptations to existing computer systems, in order to provide visually impaired users with the possibility of writing Chinese characters, should therefore no longer be considered. On the contrary developers of computer input systems and those who argue whether Chinese characters should be kept or exchanged for a phonetic script will be able to learn much from visually impaired persons. The study has pointed out that it is highly likely that visually impaired persons will sooner or later use an equivalent to the Chinese character script. Visually impaired persons in China will therefore have to develop for themselves an efficient representation for Chinese characters, bringing into this process the experience of using a phonetic script. Having no, or hardly any, preconception of Chinese characters, such persons must be described as ideally suited for this task.

For the time being all computer input systems for Chinese characters are based on using ordinary computer keyboards. This restricts the input compared to the chorded input which is possible through Braille input. CCB2 can be used employing one stroke for one cell units, two strokes for two cell units and so forth, enabling the visually impaired users of Braille typewriter, to continue using existing writing patterns.

Translating an existing code into Braille remains a distinct possibility, if such a code takes into account the needs of the visually impaired user. Roughly speaking the only reasons not to directly translate the coding system of *Mao Yuhang*, a coding system for individual characters based on association (*lianxiangma*), are the size of its units, its use of keys and its coding of identifiers. Furthermore this system does not take into account the knowledge of the frequency of occurrence of characters. Its individual coding begins with two cell units and increases to three cell units as soon as 412 syllables have been coded. The system even uses 4 cell units for the coding of characters. It also does not take account of the possibility of the higher numbers of cell forms which are provided by Braille. In practice the only difference between the *lianxiangma* systems like the one of *Mao Yuhang* and the system described in this chapter is that the latter takes direct account of the needs and possibilities of Braille users while using a very similar approach to the underlying principle of the coding of characters.

Tadao Hasegawa's system is not very suitable for China since it is based on the Japanese reading of characters and would involve the learning of Japanese for anyone who wants to use it. This applies of course in reverse to CCB2 as well concerning its applicability in Japan or Korea.

Taiichi Kawakami's system which provides a feasible strategy of representing parts of characters which could be known to visually impaired users has the strong disadvantage of using an eight-dot system. As has been pointed out, the introduction of an eight-dot system for the representation of characters in China is not only inadvisable but also unlikely. It would involve a major change in existing facilities which appears impossible due to a lack of resourses. An eight-dot system would also depart dramatically from existing reading patterns, and presumably increase the overall size of the system.

The Korean suggestion addresses the question of representing Chinese characters regardless of their pronunciation. However, it has to be ruled out in its present form simply because of its size. Its choice of representers, graphic components and number of strokes, also appears rather unsatisfactory, in view of the findings of this study. The Korean suggestion, nevertheless, raises the issue of whether or not a shorter system could be developed which is not based on pronunciation and which would also meet the requirements of reasonably easy learning. The question is whether visually impaired users would find

such a system more desirable than a pronunciation based system like CCB2. CCB2 works on the assumption that its underlying principle is desirable at least in the Peoples' Republic of China. It does not rule out the possibility of a non-pronunciation based system but questions its desirability for visually impaired users and in any case provides an option for non-pronunciation based use too.

This study, despite having introduced CCB2 with Braille cell forms of *xianxing mangwen*, leaves open the question of which Braille cell forms to use to represent individual sounds. Assuming that it is highly unlikely that any system would be based on a dialect other than *putonghua* the Cantonese Braille version seems excluded. Use of *guoyu dianzi* or *daidiao shuangpin*, however, remains a distinct possibility. It would also present no problem to apply the two cell units as suggested in *daidiao shuangpin* to code approximately 1200 characters. Given that one cell units would also be applied, the overall average of cells per character in CCB2 could be met or even reduced. However, it seems to be questionable whether the use of *daidiao shuangpin*, which is a representation of sound including tone, would be more advantageous than a system representing sound only. As has been mentioned before the workload for a student is expected to be considerably higher if in order to identify a character the correct tonal representation has to be known.

Options for exchange

CCB2 applies a strategy of using only one meaning per Braille cell, except for the underlying use of the decimal order. Other approaches could of course attempt to attach further and different meanings to each cell. To reduce the possibility of ambiguity such an option would have to offer clear rules on the meaning of a cell depending on its position. This could to some extent unfavorably effect the cell per character average. However, an option tested during the course of developing CCB2 was a thesaurus approach. The thesaurus approach is the attempt to order the 189 graphic components of the *xinhua zidian* under 52 headings, one for each Braille cell used, according to the original meaning of the graphic components. This approach, as several others envisaged, is perfectly possible and reasonable but was not applied since CCB2 appears simpler to the users. The argument used to sustain this is: why choose a difficult approach if there is an easy one?

Summing up the results of this chapter it is clear that encoding Chinese character script according to the four given principles

- one code per character,
- all codes based on sound,
- combination of strategies applied,
- using frequency,

is possible. Doing so does not significantly increase the overall size of Chinese Character Braille when compared to existing Chinese Phonetic Braille systems. CCB2 can serve at least two different purposes. Users in the People's Republic of China cannot only still fully rely on their existing Braille, based on sound only, but they can also, based on the same reading patterns, increase their knowledge of characters to any level they, or the state authority, expect them to learn. This ensures that the system addresses the question of equality between literacy of the sighted and of visually impaired persons and the concerns about choice, as voiced during the field research. The codes chosen are exchangeable within the given parameters and therefore provide for the possibility that the users make their own informed choice. Thus it constitutes a reasonable basis for future research. In comparison to other systems which can represent Chinese characters currently available, CCB2 is preferable in aspects, identified as essential, such as size, remaining with existing reading patterns, and addressing special needs and possibilities of Braille users.

CCB2 has, however, not resolved all issues. As a system based on pronunciation, despite its underlying ordering principle which in theory overcomes this problem, it is to some extent divisive, which becomes most clear in the question of whether or not it could be used outside China, as, for example, in Japan where different readings would apply. It is divisive also inside China and while resolving the inequality between sighted persons and visually impaired persons it does not address the inequality it creates between visually impaired

users who speak putonghua as their mother tongue and those who grow up speaking another Chinese dialect. The only reason justifying this is that CCB2 appears to offer the least difficult common denominator for visually impaired persons using Chinese characters script for representation of Chinese.

Chapter 6 Summary and conclusion

The aim of this study was to assess and analyse Chinese writing systems for visually impaired persons. The assessment and analysis of the existing Chinese Phonetic Braille systems has produced evidence of serious shortcomings which effectively discriminate against visually impaired persons in Chinese society. This is reflected in the significantly lower chances which visually impaired persons have for educational, vocational and cultural development compared to sighted persons.

The shortcomings essentially arise from a discrepancy between Chinese Phonetic Braille and Chinese character script. Chinese Phonetic Braille is based solely on the phonology of Chinese despite the fact that Chinese character script is fundamentally not related to the phonology of Chinese. For visually impaired persons this discrepancy results in a state where they are unable to read or write Chinese character script. This state is described in this study as Chinese character illiteracy. The study produced evidence to show that visually impaired persons in China who use Chinese Phonetic Braille as their sole writing system, and who have not received education for the sighted before they lost their sight, do not hold significant knowledge of Chinese character script. In Chinese society the state of not knowing Chinese characters comes to result in marginalisation since it severely restricts written communication. To withhold the knowledge of Chinese characters, which is so essential to equal participation in Chinese society has, therefore, to be described as discrimination.

There appears to be a lack of interest from the respective governments in Chinese Phonetic Braille, expressed not least by their lack of regulation concerning the use of Chinese Braille all through this century. Bodies concerned with Chinese writing systems for visually impaired persons are left to almost complete self-regulation. The recently held seminars on Chinese Braille are the most obvious sign of this. Representatives of different administrations and organisations with no mandate other than their position and their expertise are left to decide between themselves the facility of communication of approximately 8 million visually impaired persons and the educational and vocational prospects of tens of thousands of visually impaired children. Amongst many other causes, it appears possible that the lack of interest from respective governments in Chinese Phonetic Braille is caused by the fact that Chinese Phonetic Braille does not represent Chinese character script and that the respective governments therefore do not have to take it seriously. For example, it would not make any sense for the government to regulate which characters or how many characters visually impaired students should have to learn in primary school or higher education, since with the current system they are unable to learn characters at all.

The fact that the discrimination created by the use of Chinese Phonetic Braille is ignored by governments, is aggravated since visually impaired users themselves lack the conviction or the desire to achieve knowledge of Chinese character script. This study produces evidence

to suggest a strong link between the belief of visually impaired persons that they cannot learn characters and their lack of desire to learn them.

For the respective governments the fact that visually impaired users cannot write or read Chinese character script must strengthen the assumption that they cannot compete in the world of the sighted, and that therefore no provisions for appropriate measures of integration have to be made. In a state of limited resources the results of this for the educational and vocational chances of visually impaired persons are disastrous. Hong Kong's exceptional position, where visually impaired persons can rely on English if they want to achieve higher education or employment may soon change. As for the apparent self-regulation of decision-making bodies in the field of Chinese writing systems for visually impaired persons, it is obvious that their approach has failed to address the task at hand. It therefore appears necessary to hold governments responsible for the introduction of legal and bureaucratic procedures to secure the same rights and duties for visually impaired persons as for the sighted. Once these parameters are set, the self-regulation of bodies concerned with Chinese Braille use and production can be restored, which means visually impaired persons can choose for themselves the most appropriate form of Chinese Character Braille.

In the light of this argument and of the findings of the field research, it may be seen to be imperative to attempt to introduce Chinese Character Braille in China, in order to set in motion the possibility of

change. The respective governments have to be convinced that in the case of Chinese characters script equal provisions for visually impaired persons and sighted persons alike are possible. For the visually impaired users it is essential to provide a medium which might overcome the vicious circle of believing that it is impossible to learn characters and not attempting to learn them. The fundamental question the study was faced with, was how could this most sensibly be achieved.

The study, in its attempt not only to produce but also to assess and analyse a system of Chinese Character Braille, has tried to avoid a singular approach. It would have been quite simple to apply certain parameters, like size, and to produce a complete system which could be the shortest possible system in terms of the average of Braille cells per Braille unit. This, however, seemed inappropriate taking into account the sensitivity of questions concerned with reform of language, written style and script in China. The study has gone to great lengths to illustrate the problems created by this sensitivity and, while reasoning that change is essential, has deliberately not produced more than a framework for future research. By introducing a prototype which can be easily altered within existing parameters it provides for wide possible input by future users in future research and the results of the pilot field research are made available to the same end.

The Chinese Character Braille system presented in this study has combined a variety of existing approaches. Some new approaches have

also been introduced, such as the use of frequency. At the same time the study has tried to concentrate on the needs of visually impaired persons. It was argued that approaches relying on the adaptation of concepts developed for the sighted are obsolete when making an investigation into the kind of Chinese character script which would be most convenient for visually impaired users. Such an investigation should not be swayed by existing preconceptions of sighted persons concerning Chinese characters. Despite the existence of Chinese Character Braille systems outside China, this study has argued for the development of an appropriate system involving Chinese users. This becomes necessary especially since a short assessment and analysis of the systems created in Korea and Japan has indicated, that they would not be fully applicable in China.

Taking into account the findings from the field work and the results of the prototype CCB2 the study concludes that visually impaired persons can use Chinese characters in their own right. The application of any Chinese Character Braille system as computer input systems for Chinese character word processing presents no problem, which means the study can also conclude that hardware solutions for a computer work-place for visually impaired persons in China are possible without demanding too much financial or technical effort.

The fact that Chinese Character Braille equals Chinese character script functionally, means that visually impaired users need all the tools the sighted have, in order to cope with the difficult system. Tools such as

dictionaries and encyclopaedias have to be produced with considerable effort and will in Braille be of enormous size. Nevertheless, having available such tools means that visually impaired persons in China would have for the first time access to the full body of Chinese culture which is represented by Chinese characters. It means that for the first time they have proper access to their own written culture.

Yet, any studies in the near future in the People's Republic have been called into question by the recent introduction of *daidiao shuangpin*. The introduction of *daidiao shuangpin* appears to be an enormous waste of time and effort since *daidiao shuangpin* does not overcome any of the major problems of Chinese Phonetic Braille which were laid open in this study. Furthermore, as a new system, *daidiao shuangpin* may prove difficult to introduce, since it is not a system which has evolved from the previous one. It strongly contrasts with existing reading patterns by using different symbols. The introduction of this system would require each reader to learn a completely new set of symbols and would make all previously printed literature obsolete. A further point to be made is that the use of tonal representation in a phonetic script increases the effort which has to go into learning such a system, particularly creating problems when learning to write. It also aggravates the difficulties for users in areas where *putonghua* is not the first language.

This study has furthermore shown that the perception of Chinese characters is marked by a perception of the character as its *Corpus*

and nothing but its *Corpus*. The study has throughout applied a wider view of Chinese characters and strongly argues for the need to change the existing perception of them. Indeed it argues that in order for a change in Chinese writing systems for visually impaired persons to take place, altering the perception of Chinese characters is essential. The Chinese character has to be understood and discussed in its fullness in order to provide the possibility of understanding the capacity of Chinese Character Braille. The study has produced evidence that a change in perception is possible and the ease of such a change might be furthered by the introduction of Chinese Character Braille.

Yet, the future might be fairly bleak, at least in the next few years. To start changing the perception both of visually impaired users and of persons in decision-making positions may take considerable time. The study has discovered that opposition to the concept of Chinese Character Braille is still strong. Only when visually impaired users and persons in decision-making positions are convinced of the necessity for change can the required consultation of users begin on an appropriately large scale in order to produce the most suitable Braille code for Chinese character script. Even once such a code has been agreed upon, it will take considerable time to produce all the necessary tools like dictionaries and the essential classical and modern texts in Chinese Character Braille. Only when these are available and when visually impaired persons have learned to freely use Chinese character script and have access to sufficient media and the means to translate Chinese Character Braille into Chinese character script, which also

means access to computers, can it be hoped that the sighted population will accept that a page full of dots can equal a page full of Chinese character script, and only then can it be hoped that this may lead to the better integration of visually impaired persons in Chinese society. Only then might universities allow full access to all courses. Only then might employers make use of the potential of visually impaired persons. Although the introduction of Chinese Character Braille will not guarantee integration, the introduction of Chinese Character Braille is imperative if integration is to be made possible at all.

This study has therefore argued that the first step towards the introduction of Chinese Character Braille is well overdue in China and it has tentatively attempted this first step. The question henceforth should not be whether reform of Chinese Phonetic Braille is necessary or not, but how best to achieve it.

It must be hoped that it is only a question of time until Chinese Character Braille will be used at least by some visually impaired persons in China. Yet, with each year that passes where Chinese Character Braille is not available, a chance is lost for thousands who want access to their own culture now.

Technical notes on the Bibliography

- The bibliography of this study reflects the extent of the literature search and all sources taken into consideration for the assessment. This means that all works relevant to the subject are included in the bibliography, including works which have not been referred to in the text.

- Romanization is according to *hanyu pinyin*.

- Chinese works are listed under the name of the author according to the *hanyu pinyin* transcription. The title is first transcribed and then translated. The original Chinese reference is given directly under the transcribed and translated reference.

- Romanisation which are given in other than *hanyu pinyin* are marked with * in order to avoid confusion.

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C. Terminology

1.1.1

Dear Friend, today I ask you to participate in this test. I would like to know about your opinion concerning some questions. When answering the questions of the test, please don't be nervous. There are no right or wrong answers to the questions, there is only the expression of your opinion. For the convenience of the test please answer concisely, for example can or cannot, possible or not possible. Please try to answer every question, but if you cannot answer a question, it does not matter, please say: "I cannot answer". For reasons of accuracy in the test the researcher cannot discuss any questions with you.
Please tell me your name now, and explain the Chinese characters used in your name. The test begins now.

1.) What are your hobbies?
2.) What work would you like to do in the future?
3.) Who is the most famous blind person you know?
(Do you know who the most famous blind person is?)
4.) How old are you?
5.) What is your favorite subject at school?
6.) When were your eyes diagnosed as being impaired?
7.) What is the reason for your eye impairment?
8.) Do you have any remaining vision?
9.) In which year did you come to the School for the Blind?
10.) Where is your home town?
11.) Can you use one form of Chinese Braille?
12.) How many Chinese characters do you know?

13.) Do you think blind persons can work as piano tuners?
14.) Do you think blind persons can work as university presidents?
15.) Do you think blind persons can work as judges?
16.) Do you think blind persons can work as telephone receptionists?
17.) Do you think blind persons can work as office heads?
18.) Do you think blind persons can work as workers?
19.) Do you think blind persons can work as Western doctors?
20.) Do you think blind persons can work as doctors of Chinese medicine?

21.) Do you think you yourself can learn to use computers?
22.) Do you think you yourself can learn Chinese characters?
23.) Do you think you yourself can learn Chinese chess?
24.) Do you think you yourself can learn knitting?
25.) Do you think you yourself can learn music?
26.) Do you think you yourself can learn farming?
27.) Do you think you yourself can learn to use an English typewriter?

28.) How many subjects, do you think, can a blind student study at university: 100% or 75% or 50% or 25% or 10% or 0%?

29.) Do you think blind persons are familiar with politics: less than sighted persons, more than sighted persons, or as the same as sighted persons?
30.) Do you think blind persons are familiar with opera: less than sighted persons, more than sighted persons, or as the same as sighted persons?
31.) Do you think blind persons are familiar with classical Chinese: less than sighted persons, more than sighted persons, or as the same as sighted persons?
32.) Do you think blind persons are familiar with football: less than sighted persons, more than sighted persons, or as the same as sighted persons?
33.) Do you think blind persons are familiar with Taijiquan: less than sighted persons, more than sighted persons, or as the same as sighted persons?
34.) Do you think blind persons are familiar with literature: less than sighted persons, more than sighted persons, or as the same as sighted persons?

35.) Do you think blind persons using Chinese Braille can read and understand newspapers?
36.) Do you think blind persons using Chinese Braille can read and understand computer manuals?
37.) Do you think blind persons using Chinese Braille can read and understand philosophical texts by Xunzi?
38.) Do you think blind persons using Chinese Braille can read and understand Tang-poetry?
39.) Do you think blind persons using Chinese Braille can read and understand texts on economics?
40.) Do you think blind persons using Chinese Braille can write novels?
41.) Do you think blind persons using Chinese Braille can write classical poems?
42.) Do you think blind persons using Chinese Braille can write books on politics?
43.) Do you think blind persons using Chinese Braille can write books on philosophy?
44.) Do you think blind persons using Chinese Braille can write computer manuals?
45.) Do you think blind persons using Chinese Braille can write Chinese character riddles?

Do you believe the following attributes to be not important, a little bit important or very important for the success of a Chinese person:

46.) be a nice person?
47.) intelligent
48.) having received a good education
49.) to know Chinese characters
50.) having good friends
51.) having sight

Please say whether the following Chinese characters are the same or not the same:

52.) *chang* as in Great Wall / *zhang* as in school principal
53.) *hu* as in Hubei Province / *hu* as in lane
54.) *hua* as in China / *hua* as in plum flower
55.) *he* as in peace / *he* as in you and me

What special characteristics do the two characters *sen* and *lin* have.

56.) They have many strokes? true - not true
57.) They are both made up of radicals for tree? true - not true
58.) They are almost identical? true - not true
59.) Both have tree as their radical. true - not true

60.) What radical does the character jiu as in Gaoliangjiu have? jiu as in *number* or *two drops of water* or *ping as in bottle* or *three drops of water* or others.

61.) How many Chinese Characters has Chinese?

Which of the following Chinese character has more strokes:

62.) *ren* as in people and *ren* as in knowing
63.) *chang* as in Great Wall and *chang* as in factory
64.) *jie* as in festivity and *jie* as in marrying
65.) *le* as in "that's ok" and *liao* as in being familiar

66.) Do you think blind persons using Chinese Braille can write letters to sighted persons?
67.) Do you think blind persons using Hanyu Pinyin can write letters to sighted persons?
68.) Do you think blind persons using Zhuyin Fuhao can write letters to sighted persons?
69.) Do you think blind persons using Chinese characters can write letters to sighted persons?
70.) Do you think blind persons using foreign languages can write letters to sighted persons?

Sighted persons compared with blind persons do the following jobs better or worse or the same.

71.) musician
72.) politician
73.) massage practitioner
74.) judge
75.) poet
76.) worker
77.) teacher

78.) Do you think using computers one can input Braille and then print Chinese characters?
79.) Do you think using computers one can input Chinese characters and then print Braille?
80.) Do you think using computers one can write Chinese characters and Braille just the same?
81.) Does Chinese Braille need improvement?
82.) Does Chinese Music Braille need improvement?
83.) Does Classical Chinese Braille need improvement?
84.) Does Arithmetical Braille need improvement?
85.) Sighted persons say it is very difficult to learn Chinese characters. Do you yourself want to learn Chinese characters.

The test is now finished. Thank you very much for participating in the test. In the time I undertake this test at the school please do not discuss the questions of the test or your own answers with your fellow students. Thank you.

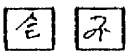
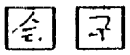
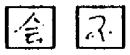
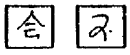
1.1.2

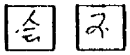
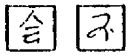
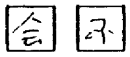
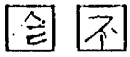
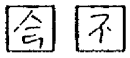
Number ..... Date..... Time..... Place..... Name.....

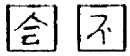
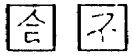
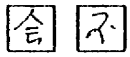
1 ..... 2 ..... 3 ..... 4 .....

5 ..... 6 ..... 7 ..... 8 .....

9 ..... 10 ..... 11 ..... 12 .....

13  14  15  16  17 

18  19  20  21  22 

23  24  25  26  27 

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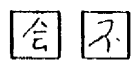
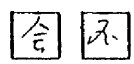
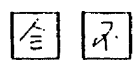
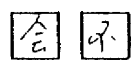
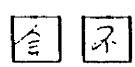
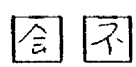
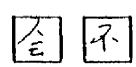
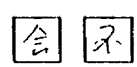
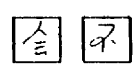
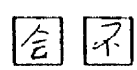
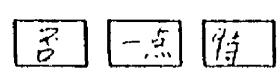
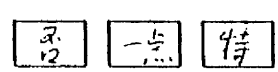
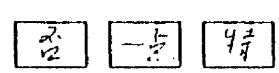
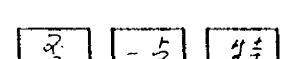
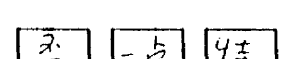
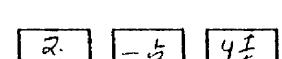
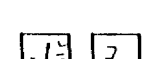
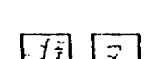
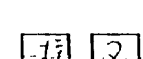
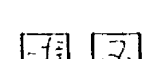
35  36  37  38  39 

40  41  42  43  44 

45 

46  47  48 

49  50  51 

52  53  54  55 

56 对 不　57 对 不　58 对 不　59 对 不

60 数目字的九 两点水 瓶子的瓶 三点水 其他　61

62 人 从　63 长 厂　64 节 结　65 了 了

66 可 不　67 可 不　68 可 不　69 可 不　70 可 不

71 好 孩 打　72 好 孩 打　73 好 孩 打　74 好 孩 打

75 好 孩 打　76 好 孩 打　77 好 孩 打

78 可 不　79 可 不　80 可 不　81 要 不　82 要 不

83 要 不　84 要 不　85 要 不

Number..... Date..... Time..... Place..... Name.....

Comments

1.1.3

尊敬的朋友.今天我請你参加这个调查.我想了解你对于一些问题的看法.回答调查的问题时,請你不要紧张.问题的回答没有标准答案,只能表示你自己的看法.为了调查的方便請你回答得简短:比如说会还是不会,可以还是不可以.請你试一试回答每一个问题,可是如果一个问题你不会回答,没有关系,請你说:"不能回答".为了调查的精確性,调查员不能跟你讨论什么问题.

請你现在把你的名字告诉我,讓我了解名字里用的汉字是什么汉字.

调查现在开始.

1 — 你的爱好是什么?

2 — 将来你打算作什么工作?

3 — 你知道最有名的盲人是谁?

4 — 你多少岁了?

5 — 你在学校最喜欢的课程是什么?

6 — 你的眼睛是哪一年被诊断为残疾的?

7 — 你的眼睛残疾的愿因是什么?

8 — 你是低视力还是全盲的?

9 — 你哪一年来盲童学校上学?

10 — 你的故乡在哪儿?

11 — 你会用中国盲文吗?

12 — 你認识多少汉字?

13 — 你認为盲人会不会当钢琴调音师?

14 — 你認为盲人会不会当大学的校长?

15 — 你認为盲人会不会当法官?

16 — 你認为盲人会不会当电话接线员?

17 — 你認为盲人会不会当办公室主任?

18 — 你認为盲人会不会当工人？

19 — 你認为盲人会不会当西医生？

20 — 你認为盲人会不会当中医生？

21 — 你想你自己会不会学用电脑？

22 — 你想你自己会不会学汉字？

23 — 你想你自己会不会学象棋？

24 — 你想你自己会不会学编织？

25 — 你想你自己会不会学音乐？

26 — 你想你自己会不会学种地？

27 — 你想你自己会不会学用英文的打字机？

28 — 你認为上大学的盲学生可以学习多少正业？
100%,还是,75%,还是,50%,还是,25%,还是,10%,还是0%.

29 — 你認为盲人了解政治比有视力的人少,多,还是跟有视力的人一样？

30 — 你認为盲人了解戏剧比有视力的人少,多,还是跟有视力的人一样？

31 — 你認为盲人了解古文比有视力的人少,多,还是跟有视力的人一样？

32 — 你認为盲人了解足球比有视力的人少,多,还是跟有视力的人一样？

33 — 你認为盲人了解太极拳比有视力的人少,多,还是跟有视力的人一样？

34 — 你認为盲人了解文学比有视力的人少,多,还是跟有视力的人一样？

35 — 你認为盲人用中国盲文会不会读明白报纸？

36 — 你認为盲人用中国盲文会不会读明白电脑说明书？

37 — 你認为盲人用中国盲文会不会读明白荀子的哲学文献？

38 — 你認为盲人用中国盲文会不会读明白唐诗？

39 — 你認为盲人用中国盲文会不会读明白经济学文件？

40 — 你認为盲人用中国盲文会不会写小说？

41 — 你認为盲人用中国盲文会不会写古文诗？

42 — 你認为盲人用中国盲文会不会写政治书籍？

43 你認为盲人用中国盲文会不会写哲学书籍？

44 你認为盲人用中国盲文会不会写电脑说明书？

45 你認为盲人用中国盲文会不会写汉字谜语？

你認为以下条件对一个中国人的成功否重要，或一点重要，或特别重要？

46 作一个好人？
47 聪明？
48 受过良好的教育？
49 認识汉字？
50 有好朋友？
51 有视力？

請你说出以下的汉字一样还是不一样。

52 长城的长 和 校长的长？
53 湖北的湖 和 胡同的胡？
54 中华的华 和 梅花的花？
55 和平的和 和 我和你的和？

森林这两个汉字有什么特点？

56 它们的笔画很多，对不对？
57 它们都是由木字组成，对不对？
58 它们几乎一样，对不对？
59 它们都有木字作偏旁部首，对不对？

高粱酒的酒这个汉字有什么部首？

60 数目字的九，还是两点水，还是瓶子的瓶，还是三点水，还是其他？

61 中文有多少汉字？

以下那一个汉字的笔画多？

62 人民的人 和 認识的認？
63 长城的长 和 工厂的厂？
64 节日的节 和 结婚的结？
65 好了的了 和 了解的了？

66 你認为盲人用中国盲文可以不可以给有视力的人写信？

67 你認为盲人用汉语拼音可以不可以给有视力的人写信？

68 你認为盲人用注音符号可以不可以给有视力的人写信？

69 你認为盲人用汉字可以不可以给有视力的人写信？

70 你認为盲人用外语可以不可以给有视力的人写信？

有视力的人比较盲人作以下的工作时好，还是不如，还是一样呢？

71 — 音乐家？
72 — 政治家？
73 — 按摩师？
74 — 法官？
75 — 诗人？
76 — 工人？
77 — 老师？

78 — 你認为用电脑可以不可以输入盲文然后印出汉字？

79 — 你認为用电脑可以不可以输入汉字然后印出盲文？

80 — 你認为用电脑可以不可以写汉字和盲文都一样？

81 — 中国盲文需要不需要改良？

82 — 中国音乐盲文需要不需要改良？

83 — 古文盲文需要不需要改良？

84 — 数学盲文需要不需要改良？

85 — 有视力的人说学习汉字很困难？你自己要不要学习汉字？

调查现在结束了

非常感谢你参加这个调查．我在学校作调查的期间，請你不要跟同学们讨论调查的问题或你自己的回答．

谢谢

1.1.4

List of Locations

Specialist schools for visually impaired persons

Beijing School for the Blind, P.R.C
北京盲人學校

Changchun University, Special Education Department, P.R.C
長春大學

Ebenezer School for the Blind, Hong Kong,
香港心光盲人學校

Guangzhou School for the Blind, P.R.C
廣州市盲人學校

Nanning School for the Blind, P.R.C
南寧盲人學校

Taipei School for the Blind, Taiwan
台北市立啓明學校

Tianjin School for the Blind, P.R.C
天津市盲人學校

Wuhan School for the Blind, P.R.C
武漢市盲人學校

Rural areas where integrated education was observed

Guangxi Province, Tianyang County, P.R.C
廣西省,田陽縣

Hubei Province, Zigui County, P.R.C
湖北省,秭歸縣

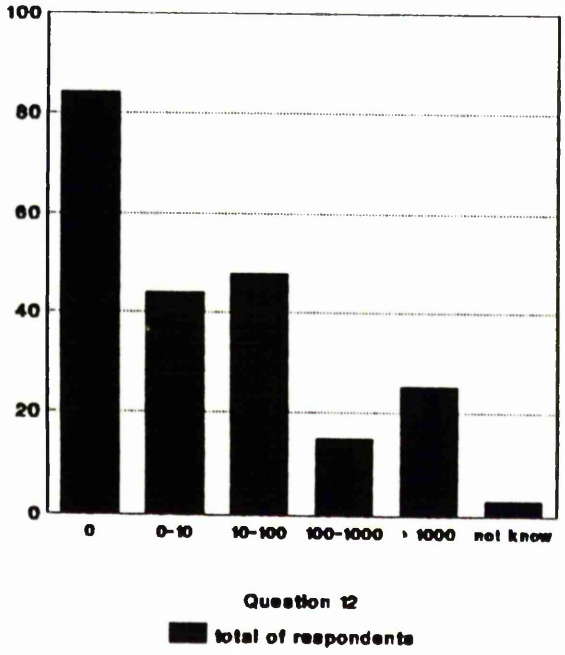
1.2 General Results (charts)

The following charts contain the results of the fully structured interview.

The charts 1.2.1 to 1.2.26, 1.5.1 to 1.5.16 give absolute numbers of respondents.

The charts 1.3.1 to 1.3.80, 1.4.1 to 1.4.18, 1.6.1 to 1.6.4 give percentages per answer.

1.2.1



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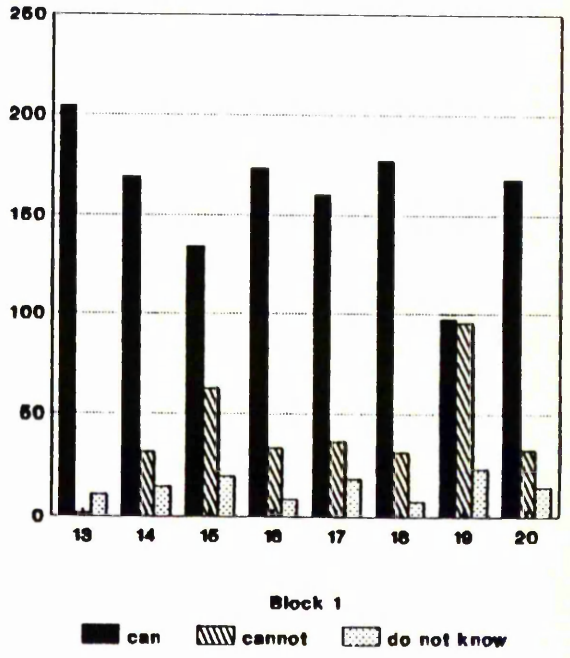

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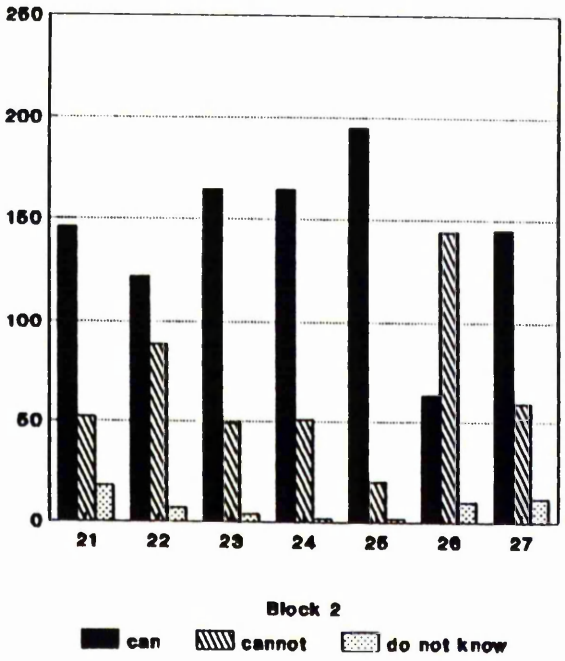

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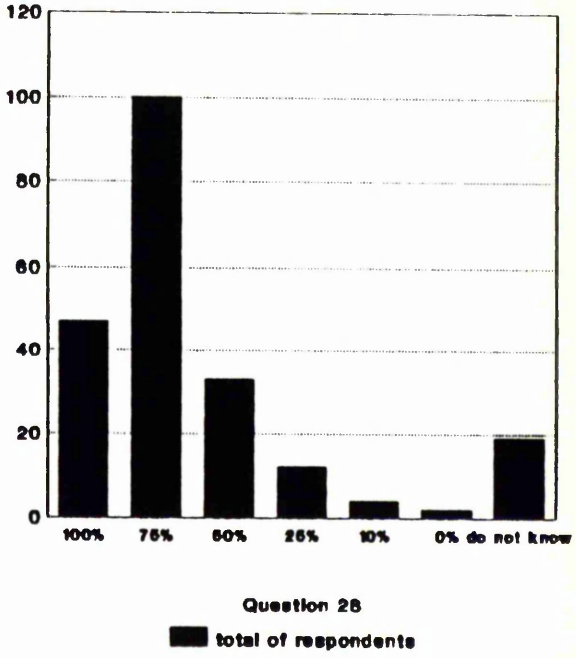

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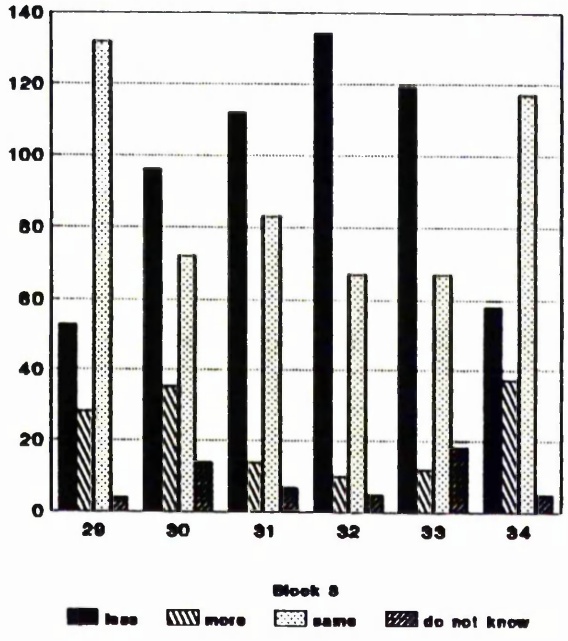

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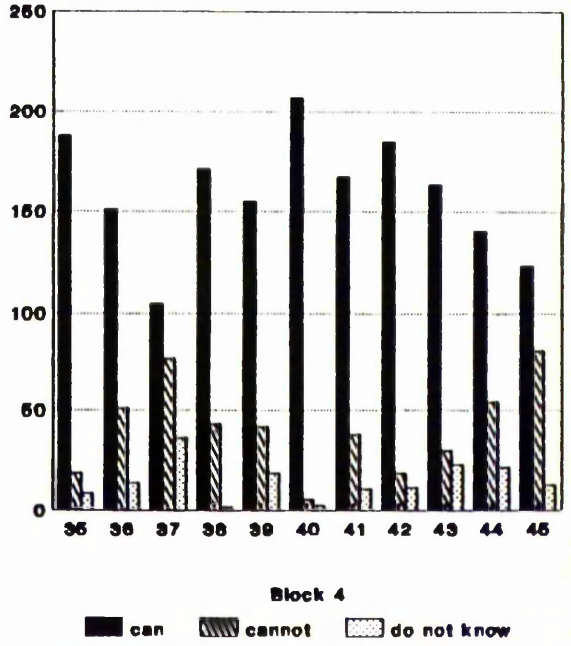

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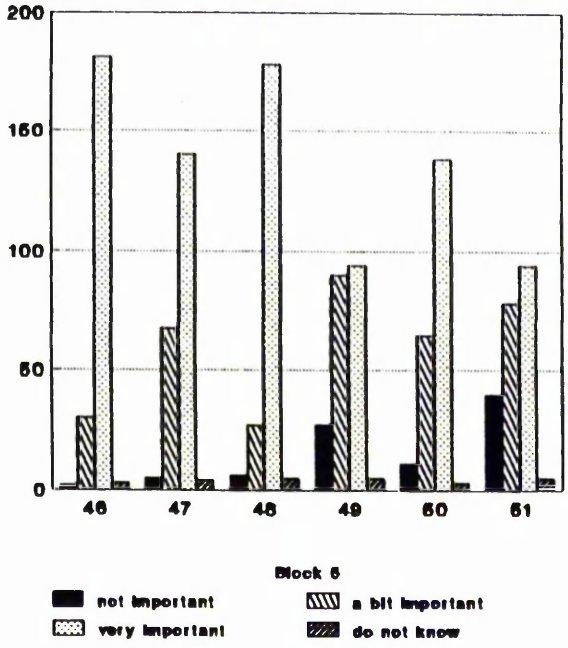

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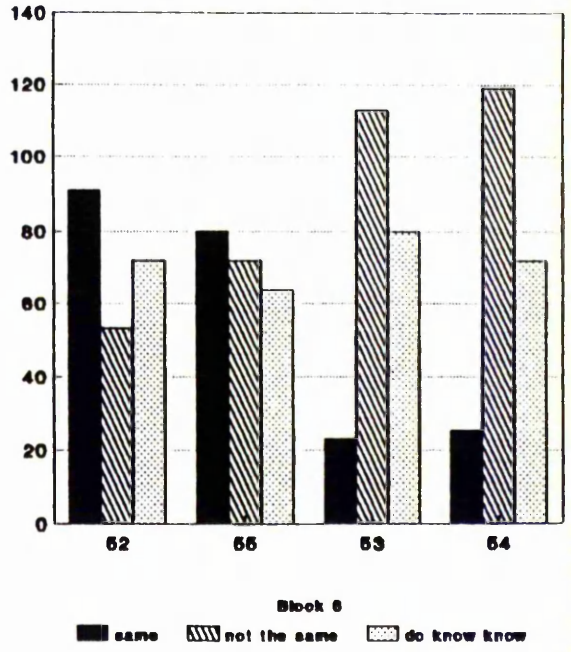

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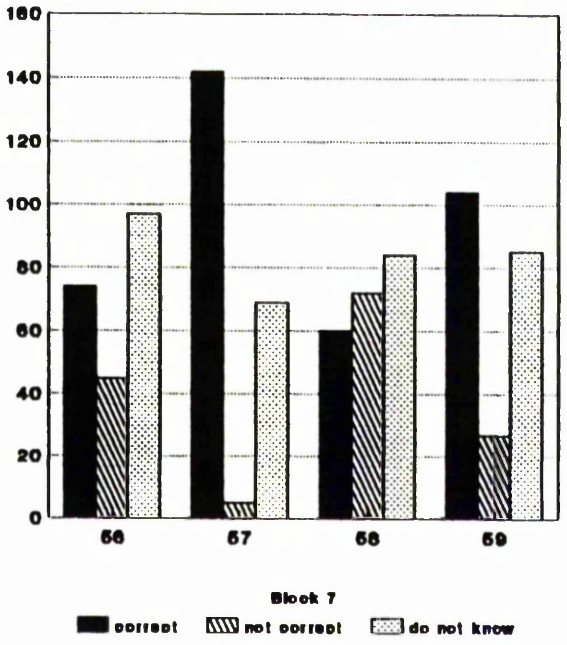

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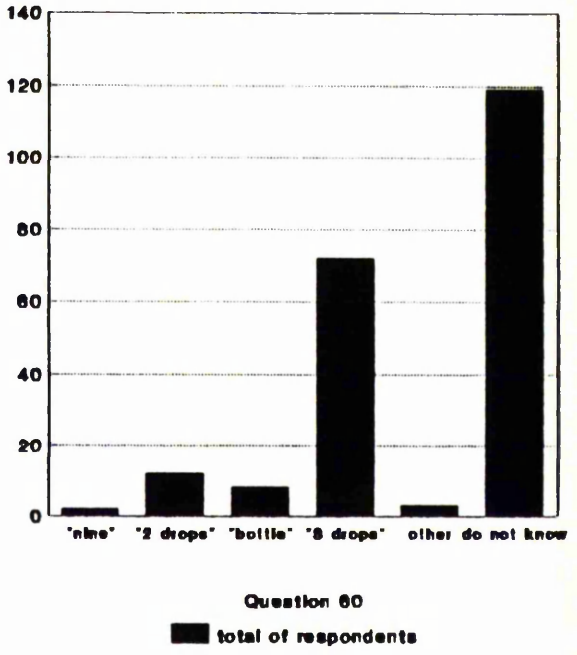

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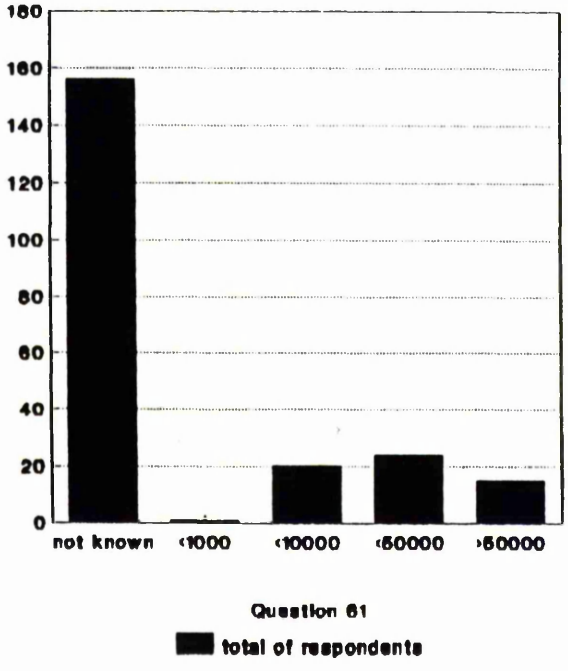

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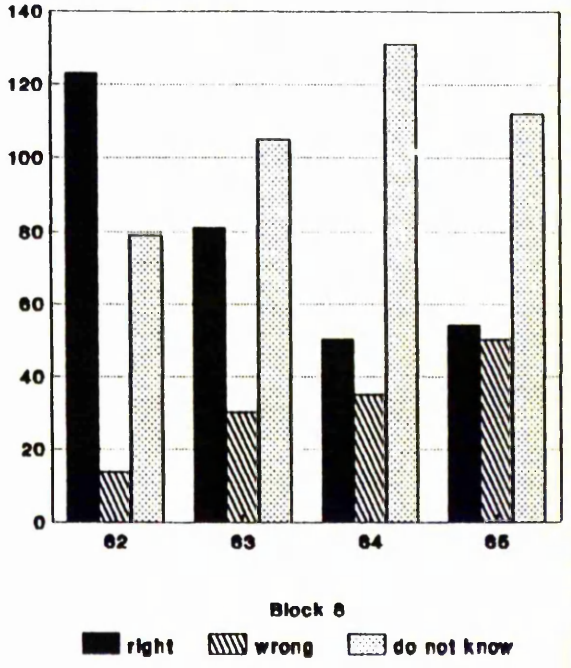

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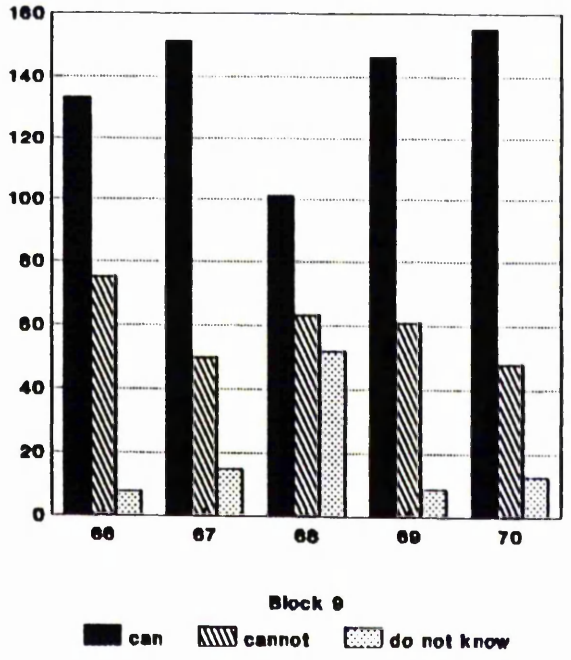

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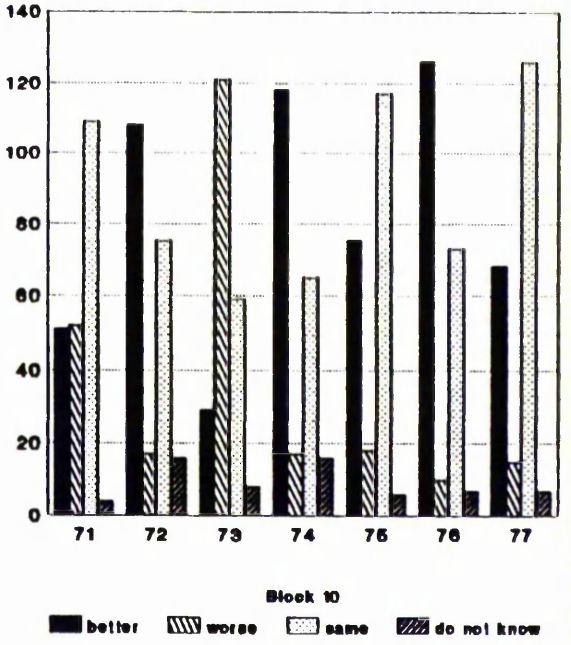

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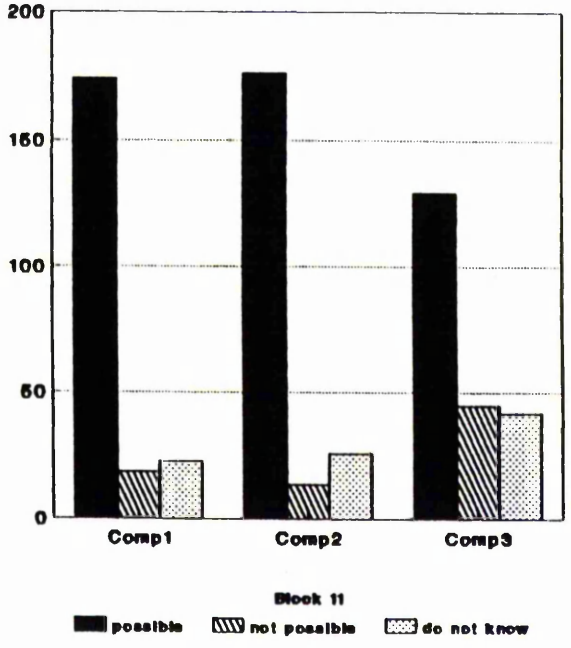

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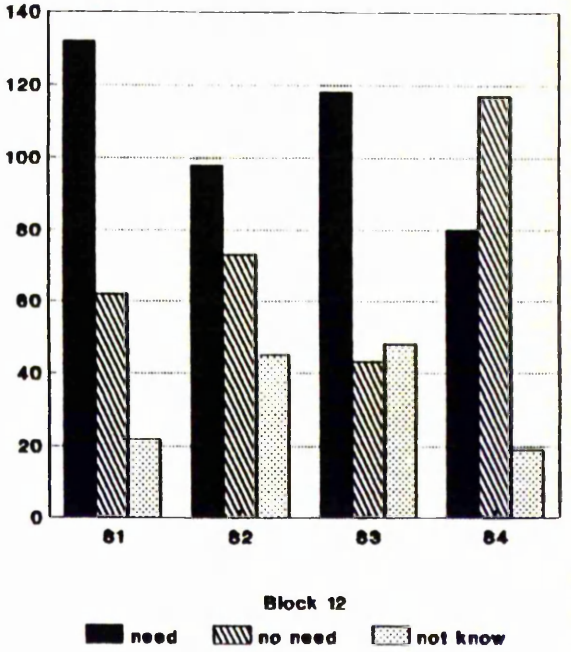

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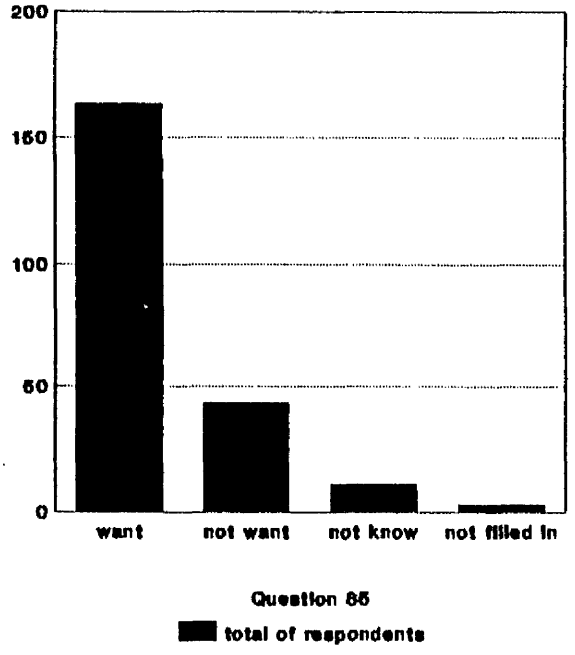

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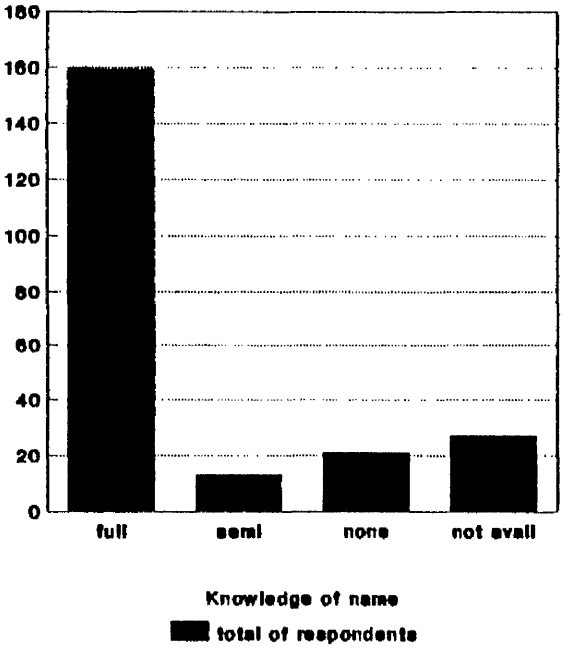

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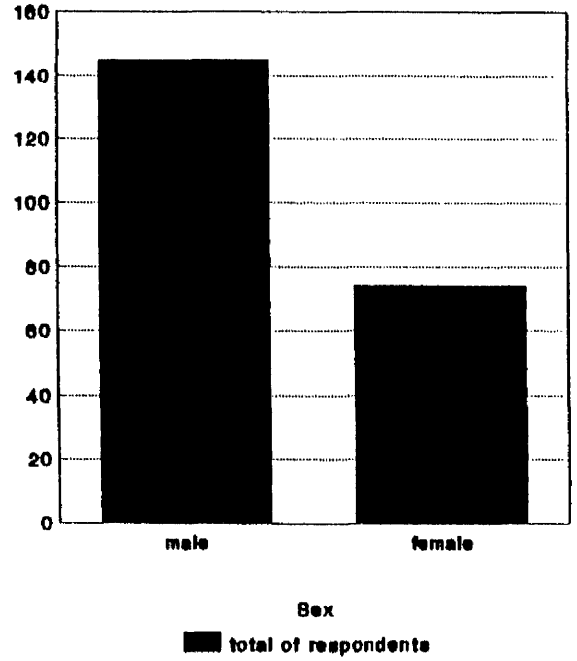

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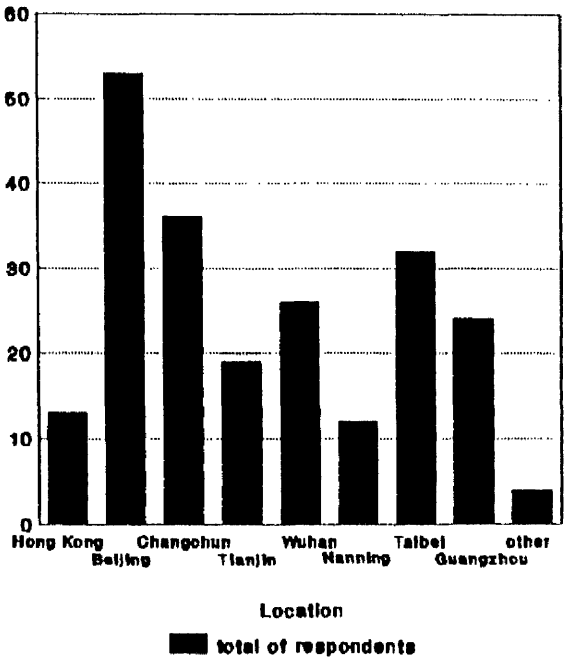

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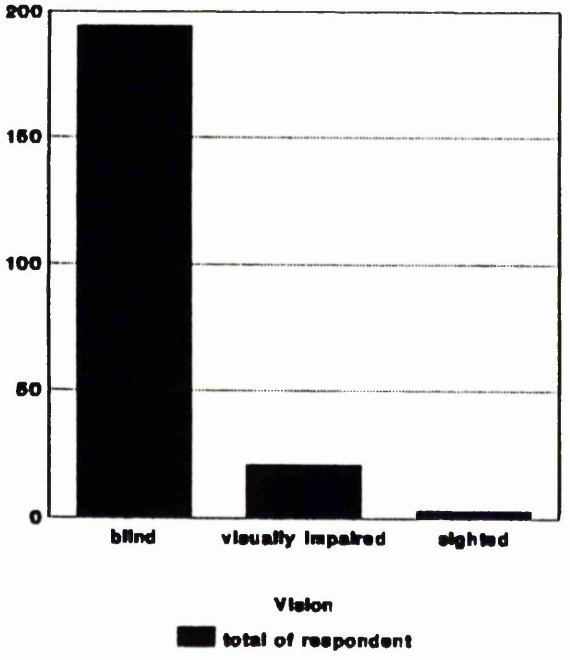

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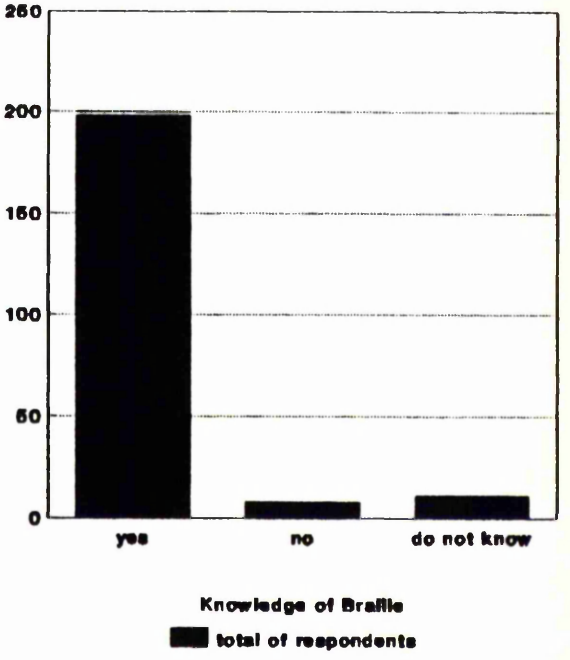

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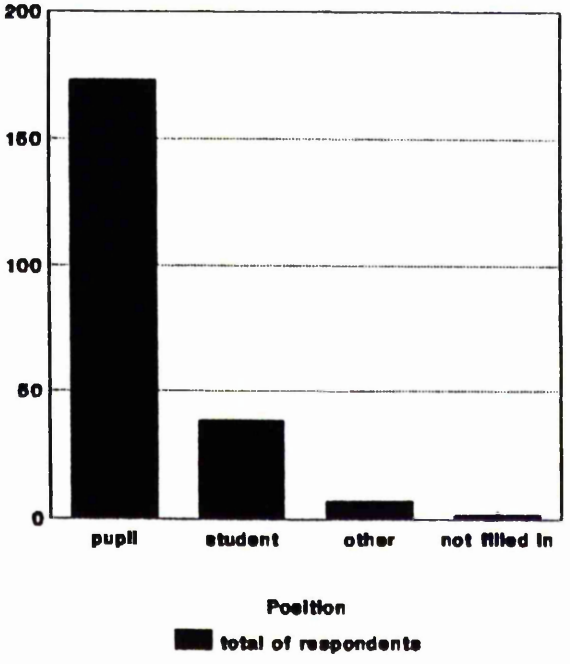

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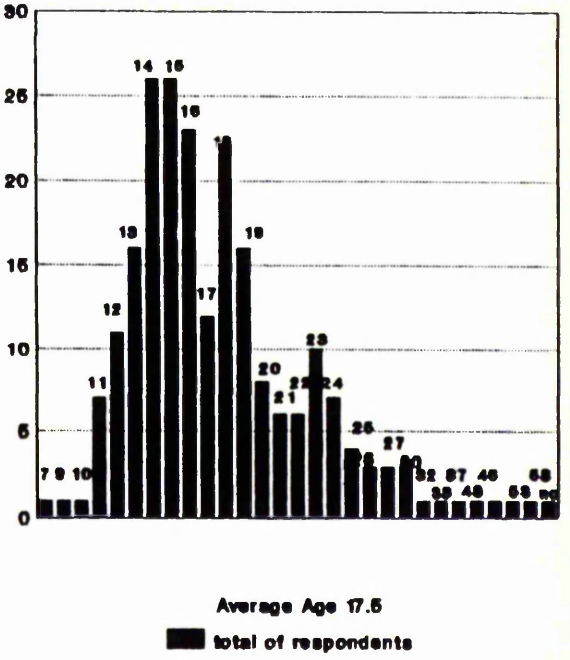

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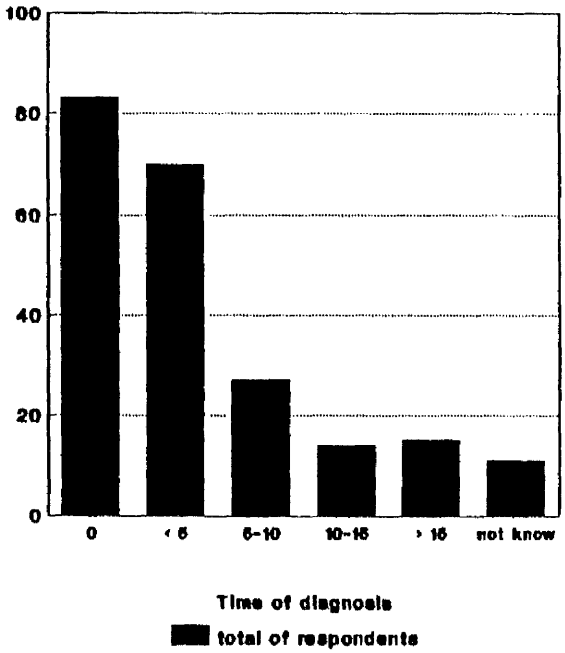
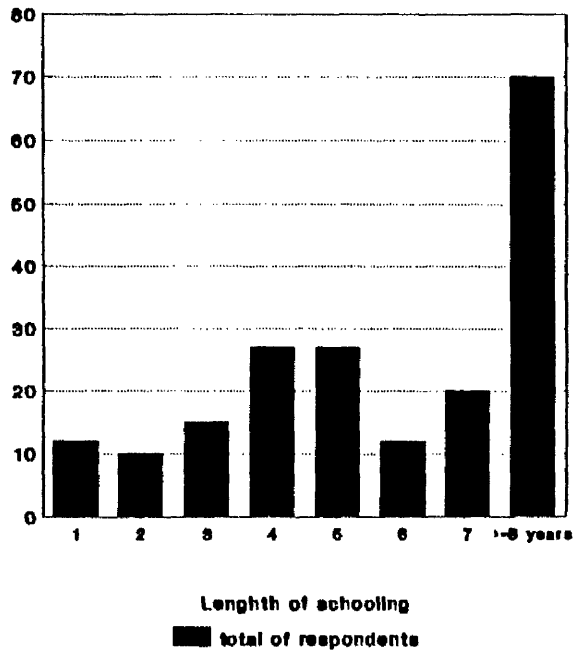
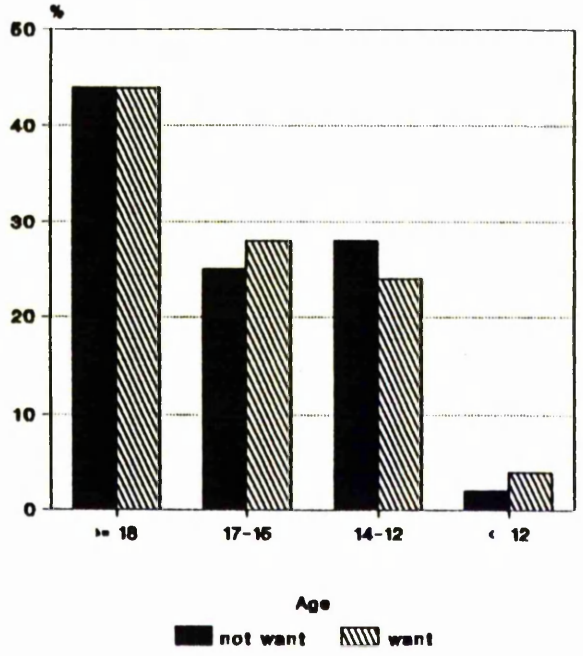

100
80
60
40
20
0
0
< 5
5-10
10-15
> 15
not know
Time of diagnosis
total of respondents

1.2.26


80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
>8 years
Lenghth of schooling
total of respondents

1.3.1



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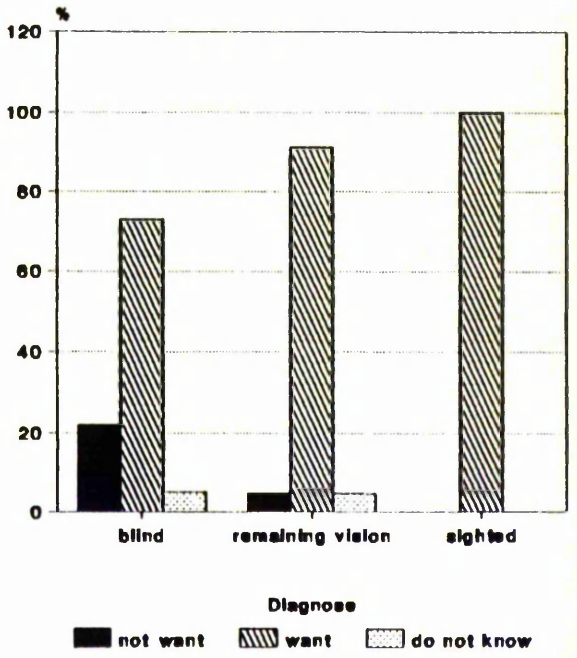

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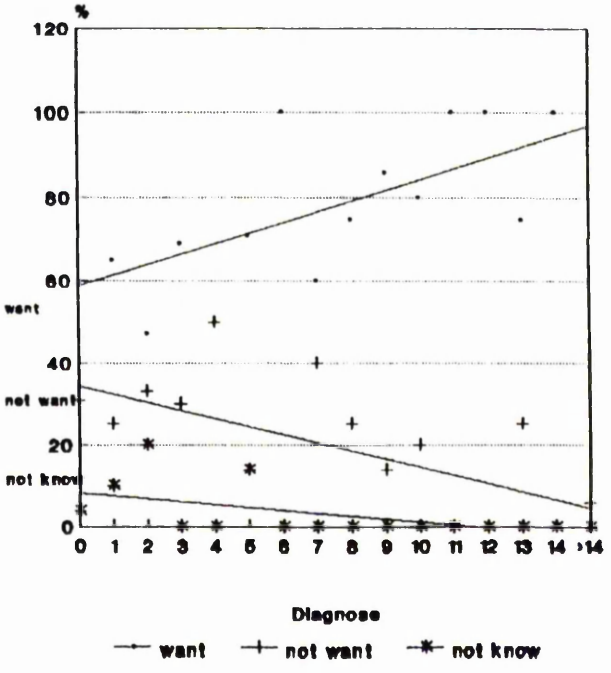

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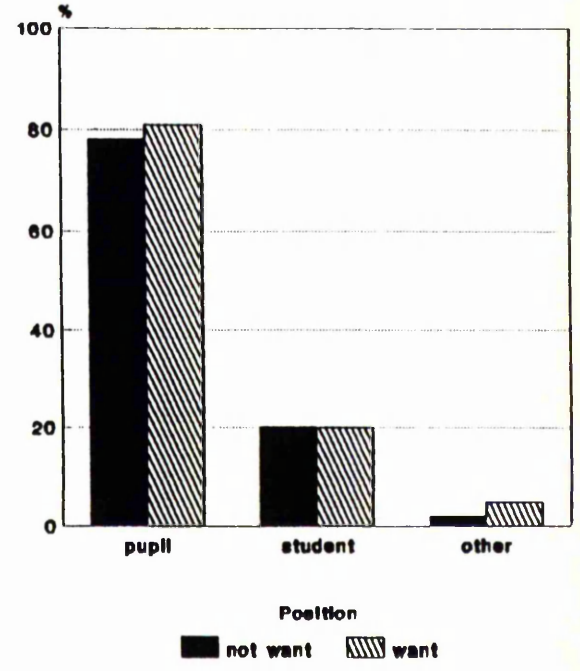

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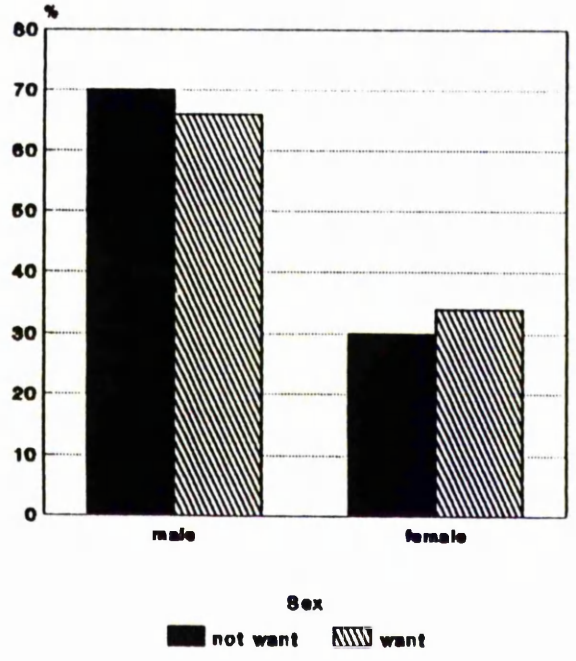

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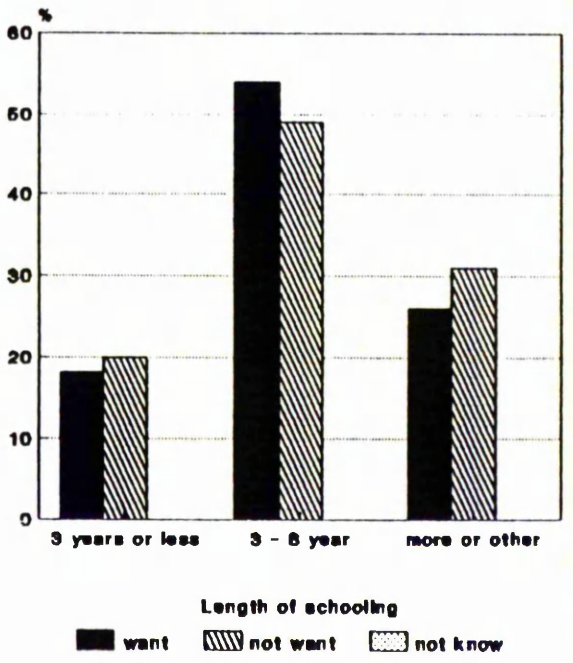

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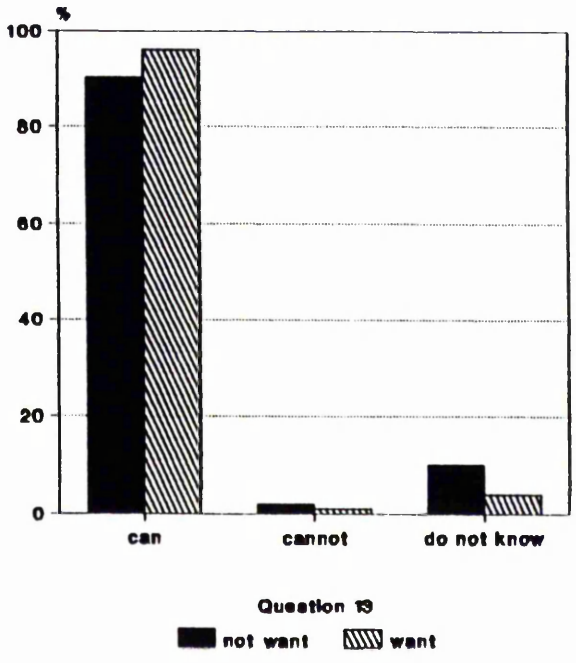

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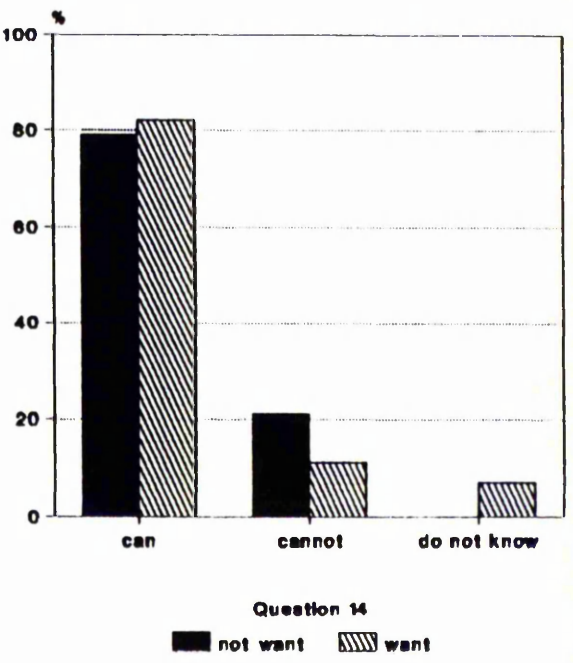

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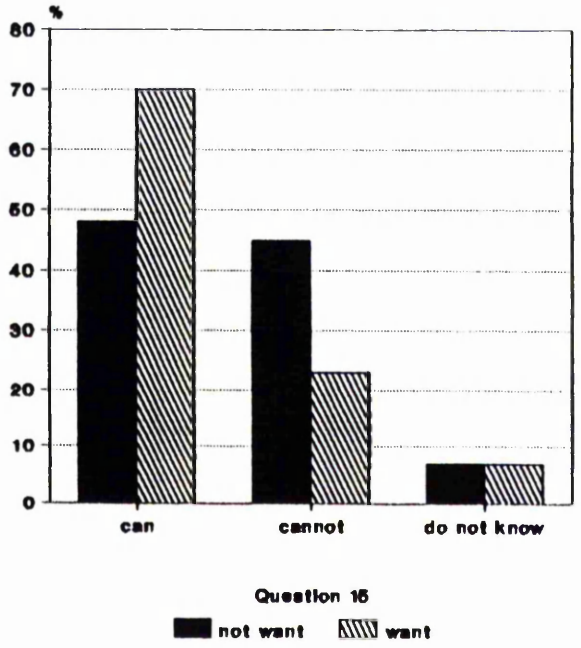

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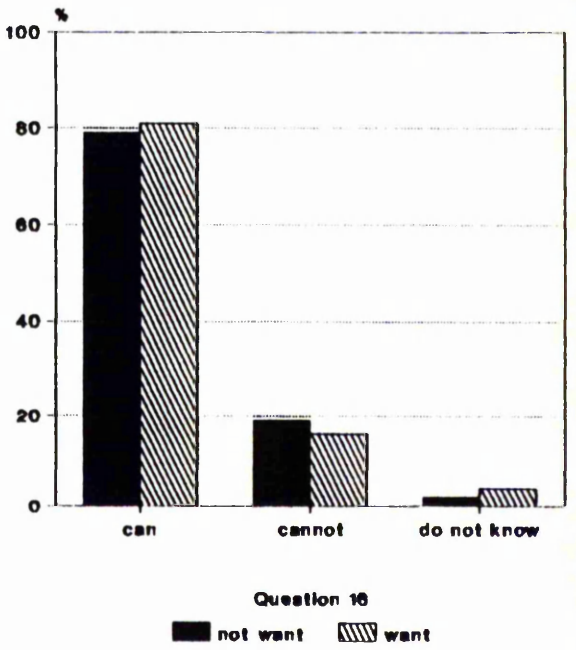

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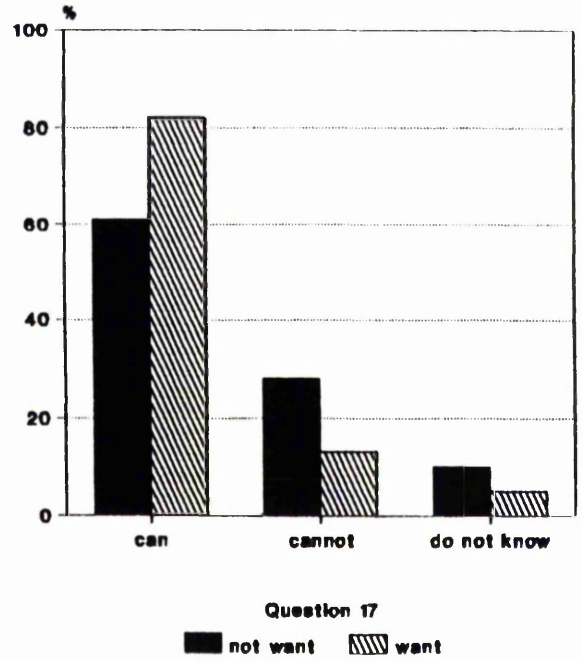

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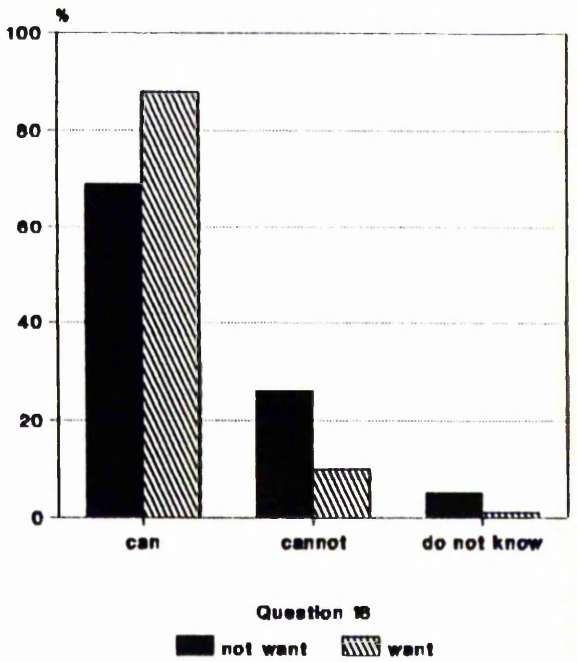

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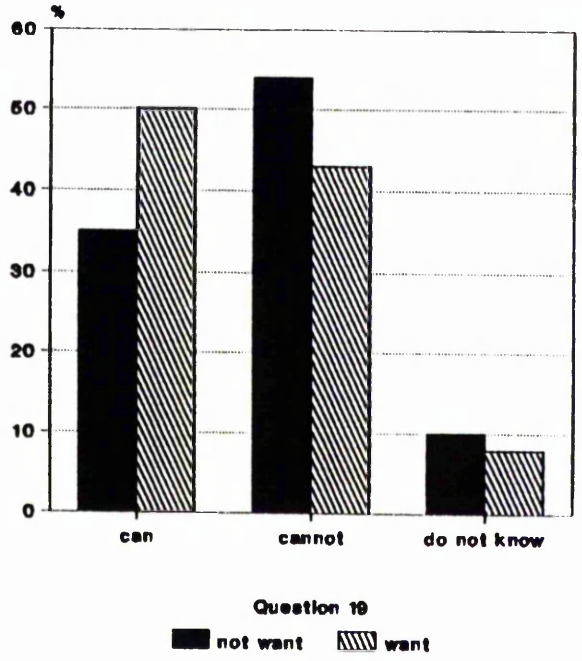

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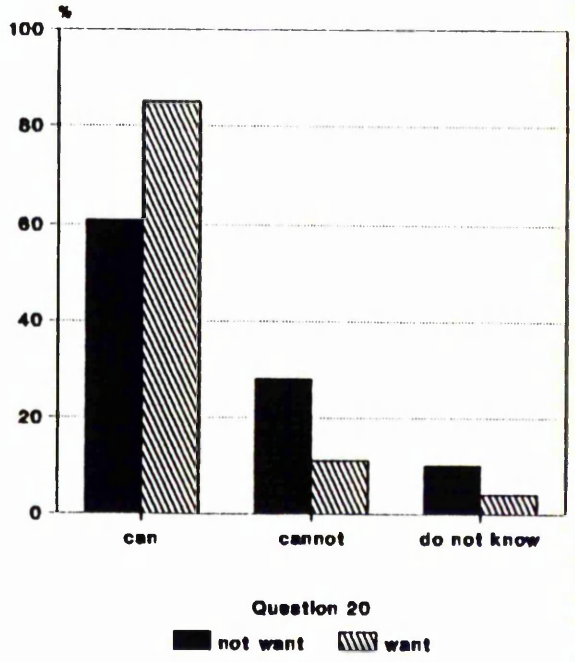

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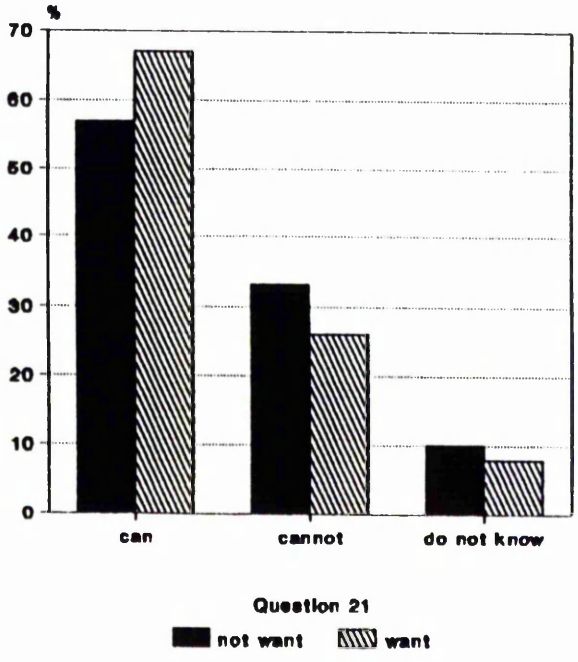

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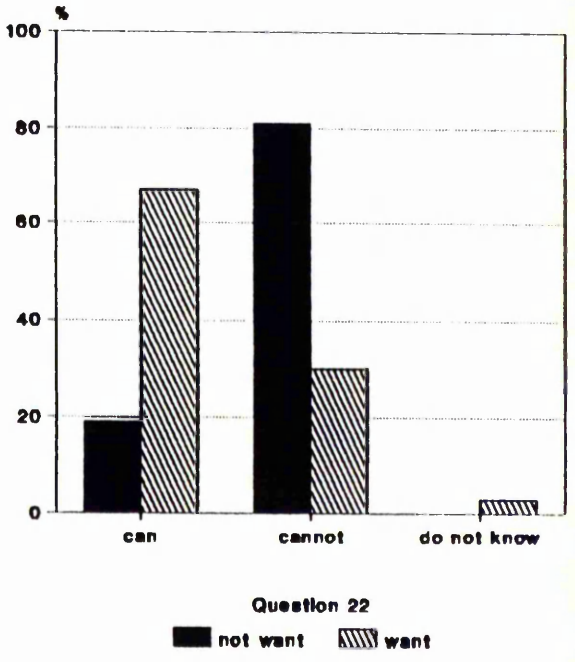

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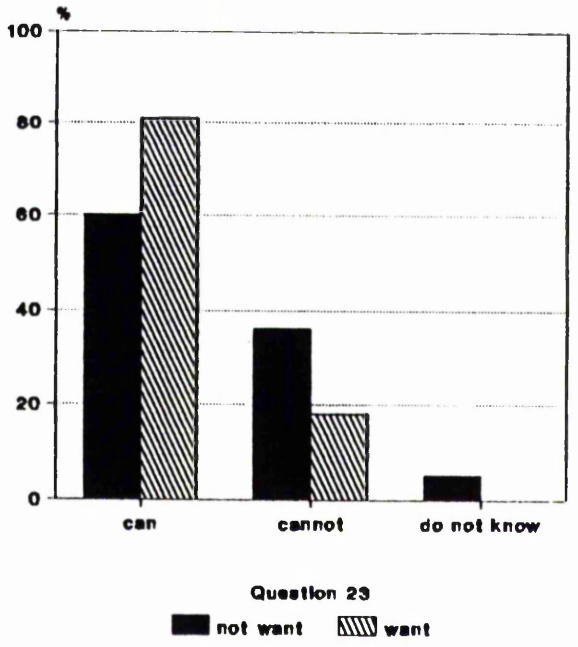

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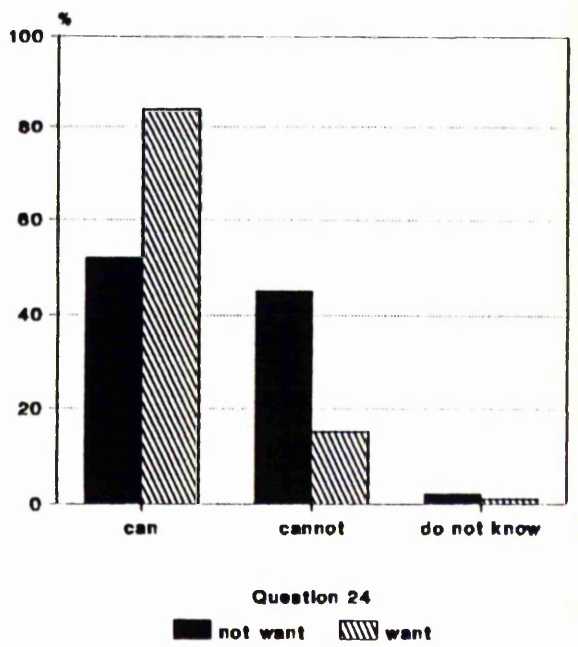

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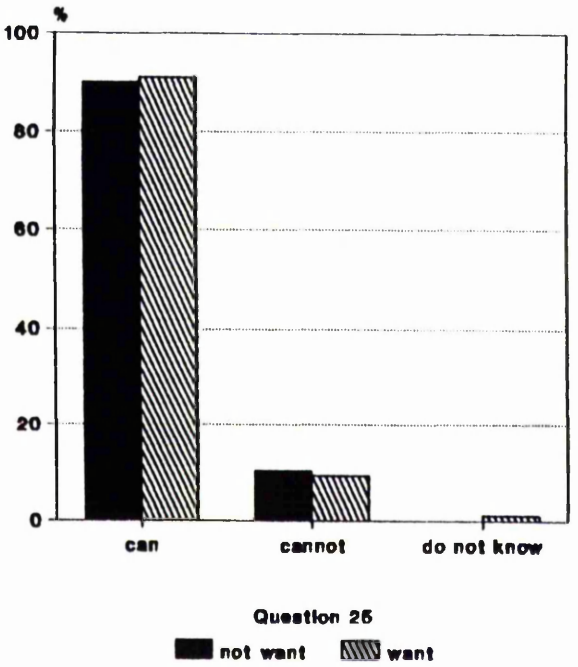

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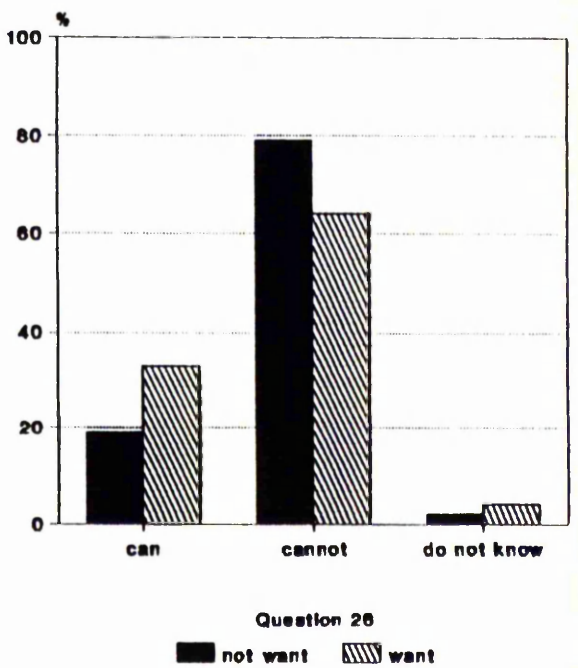

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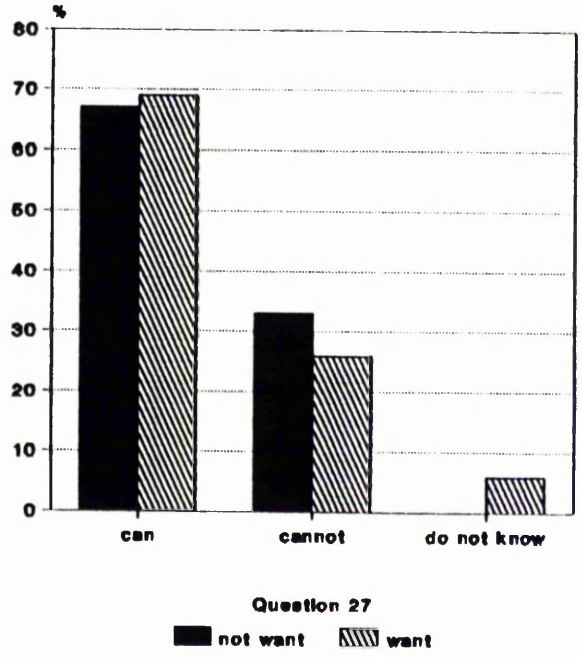

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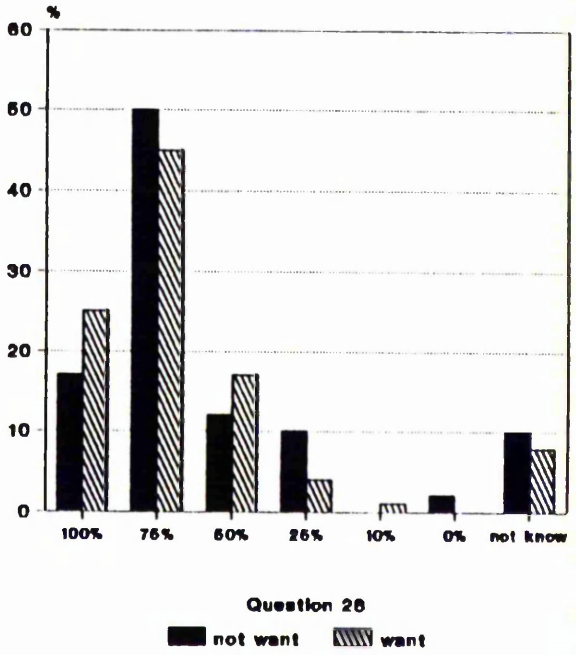

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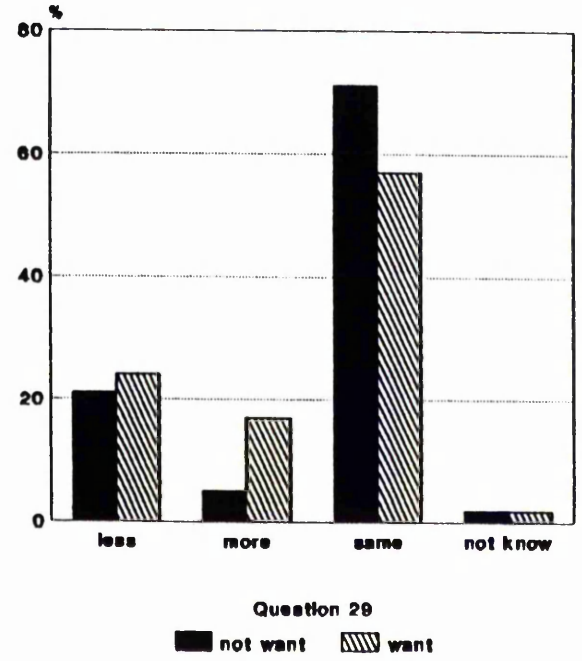

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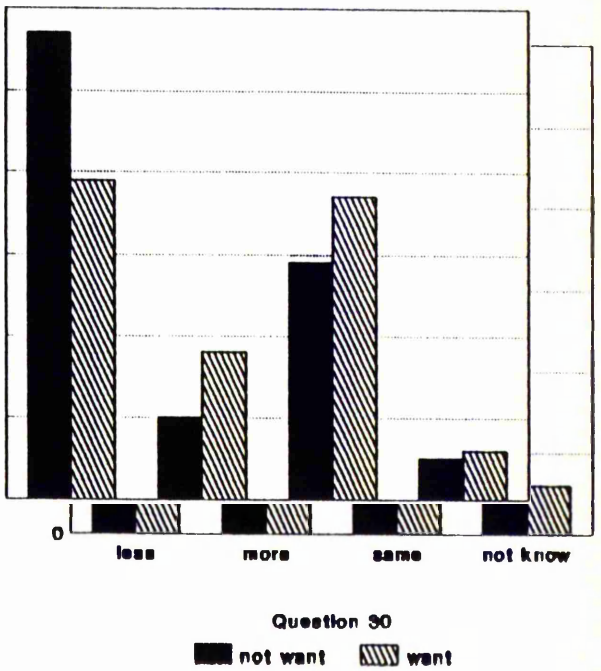

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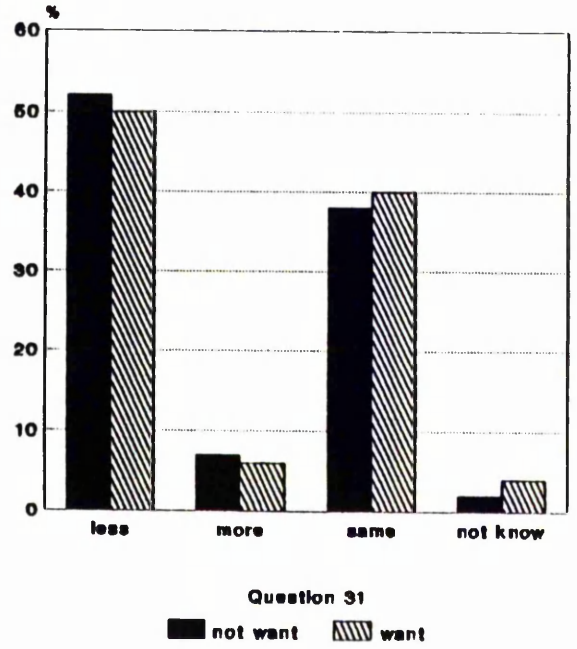

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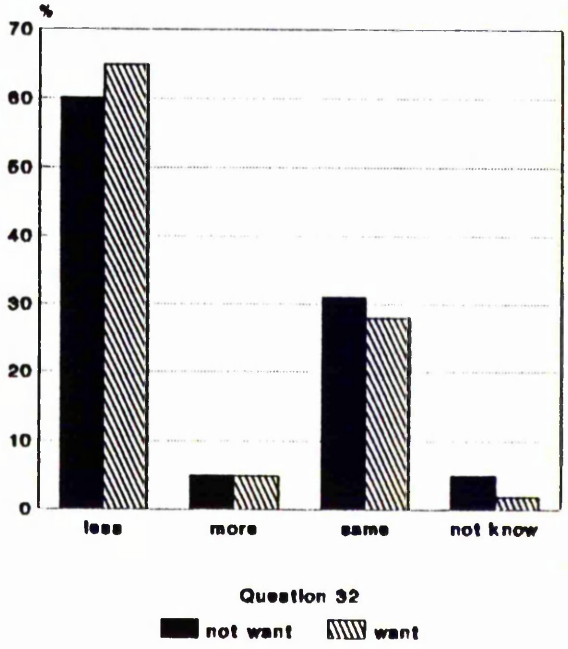

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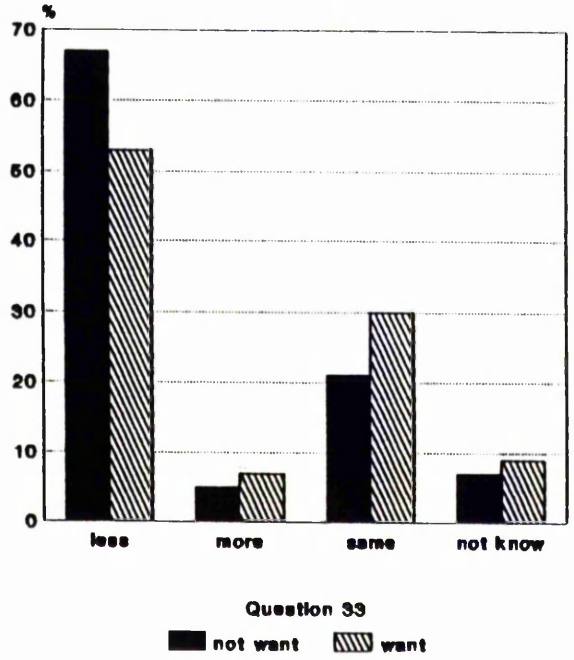

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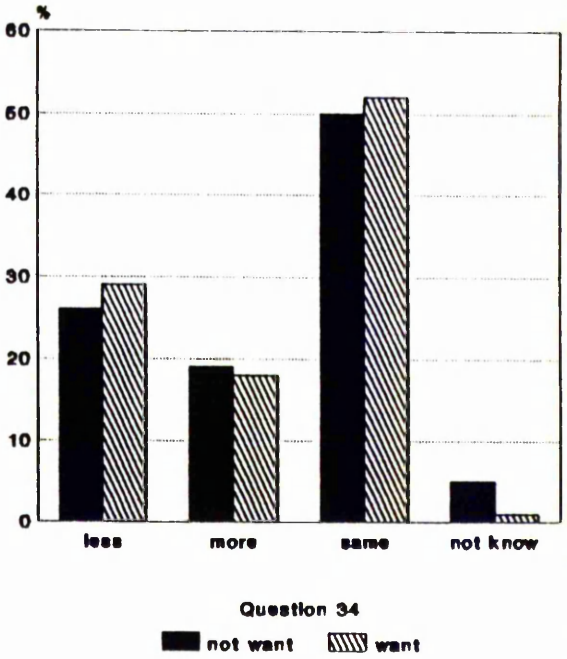

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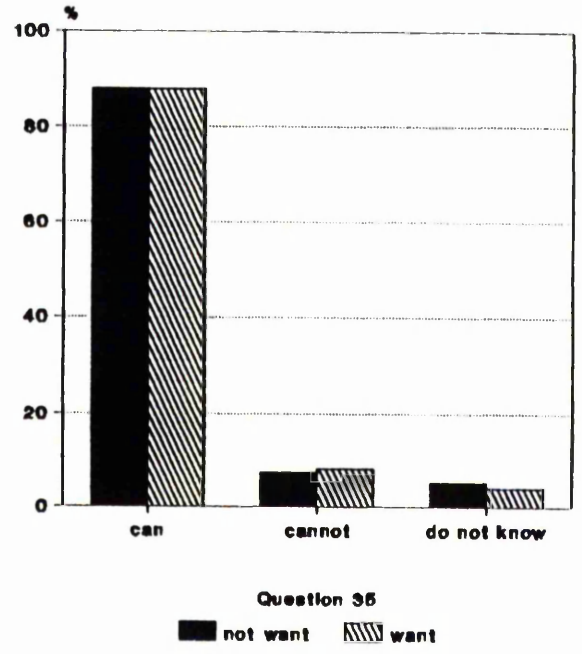

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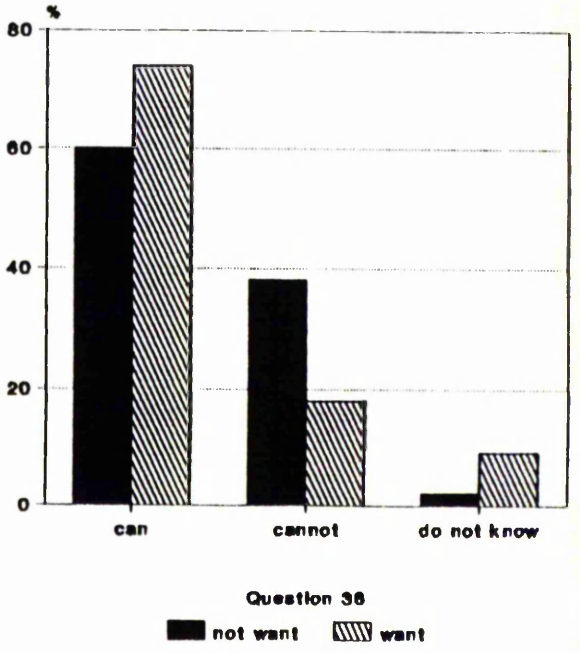

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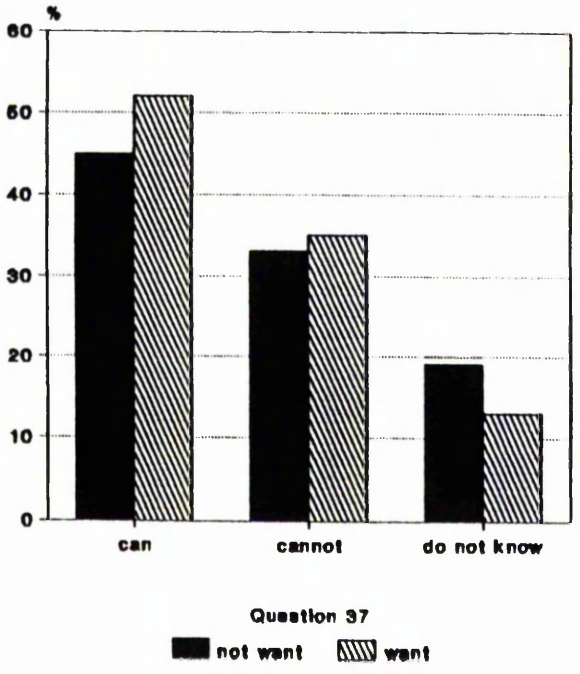

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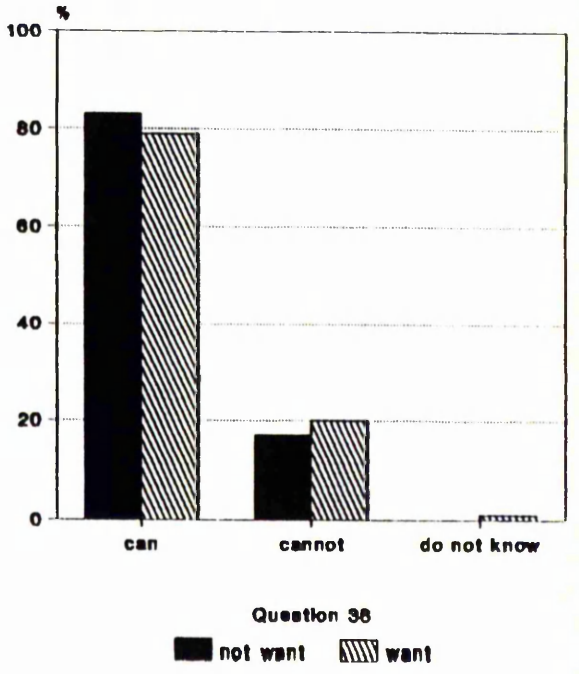

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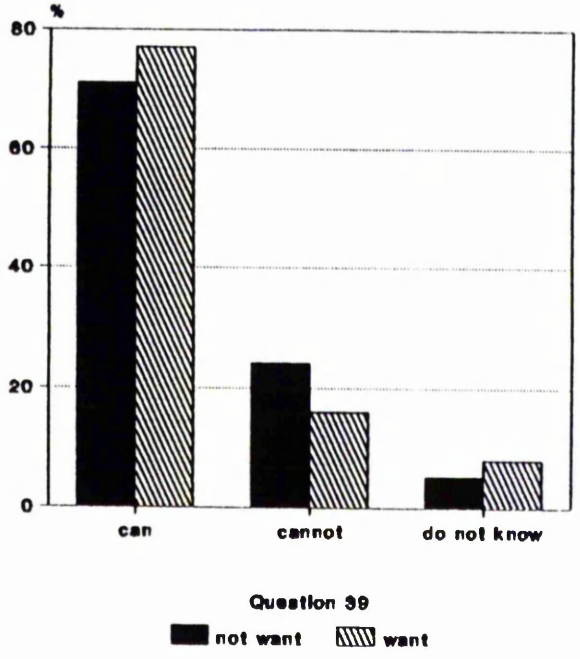

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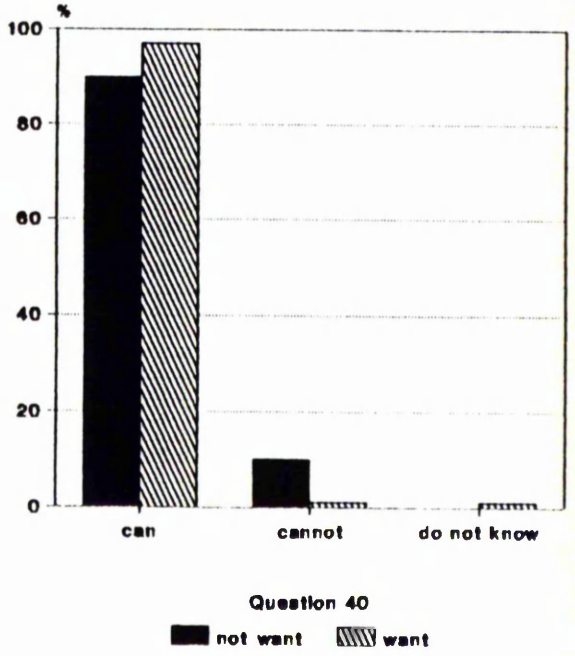

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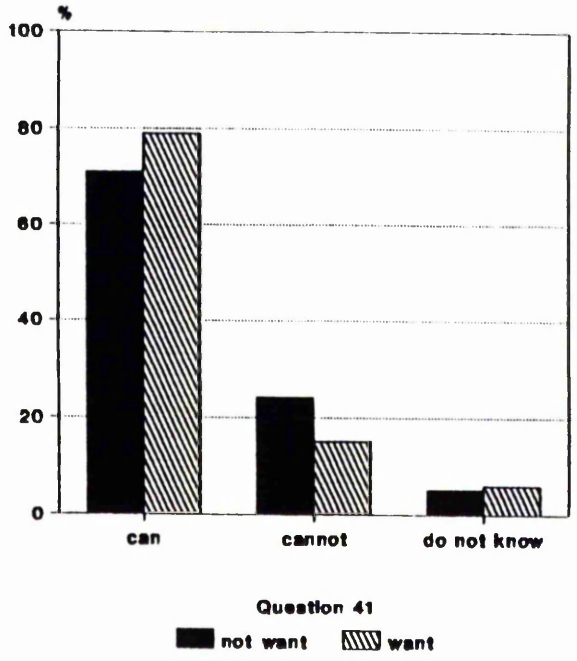

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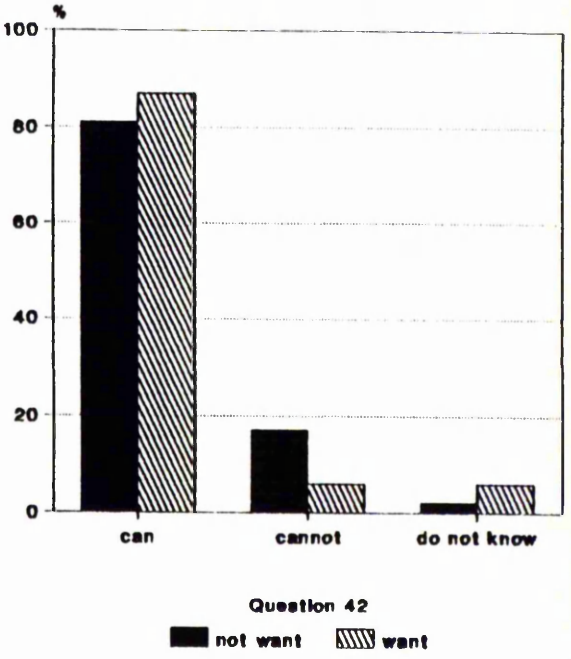

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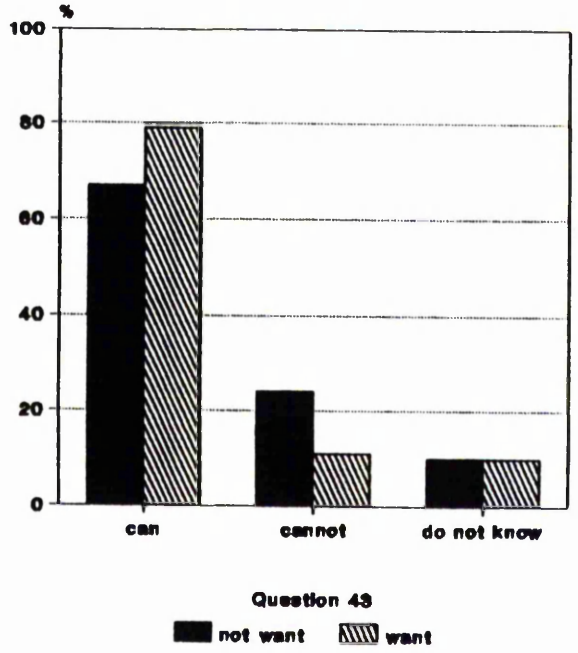

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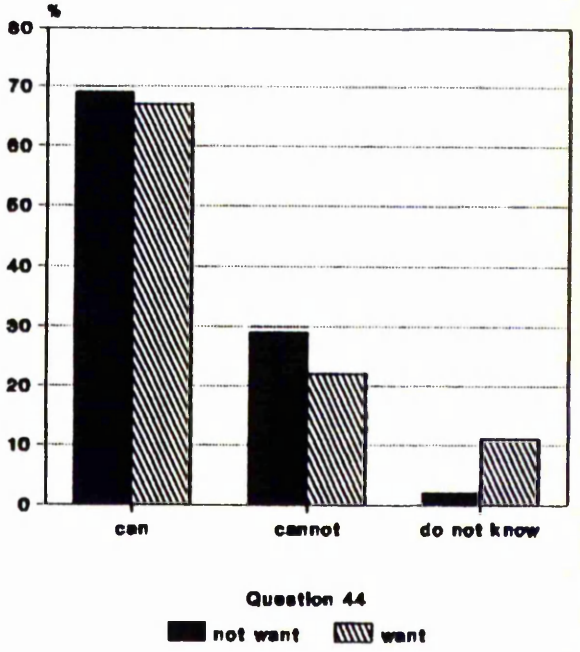

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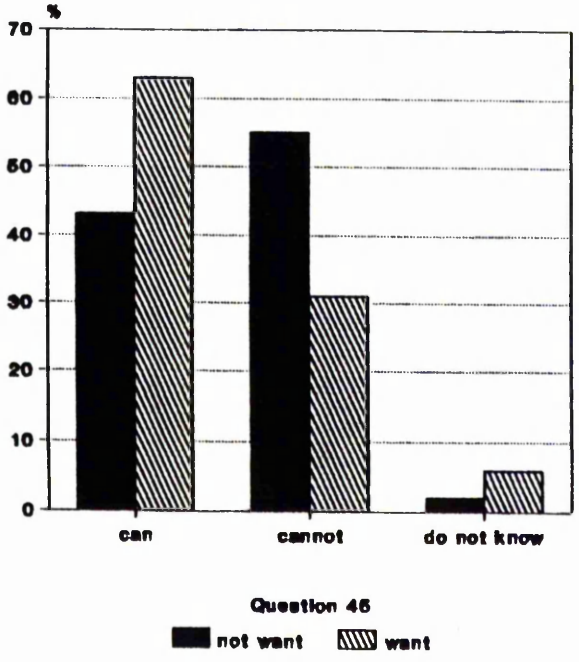

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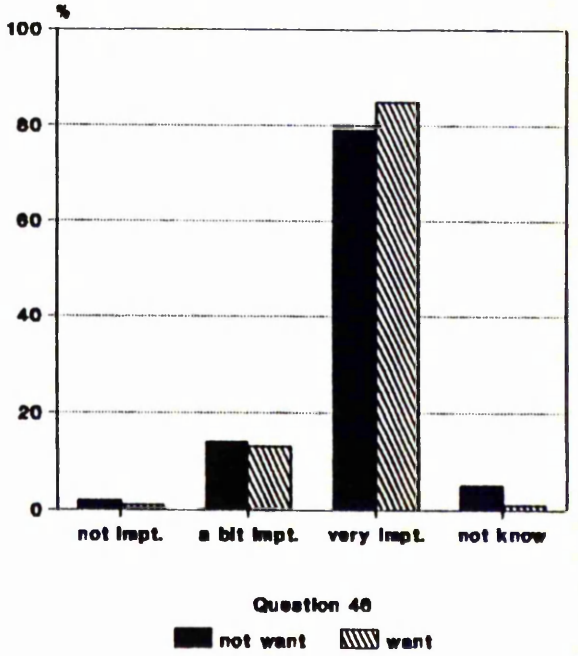

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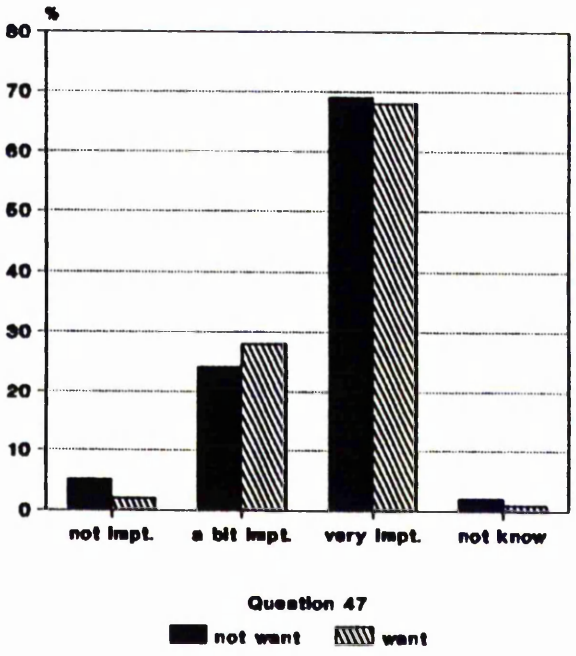

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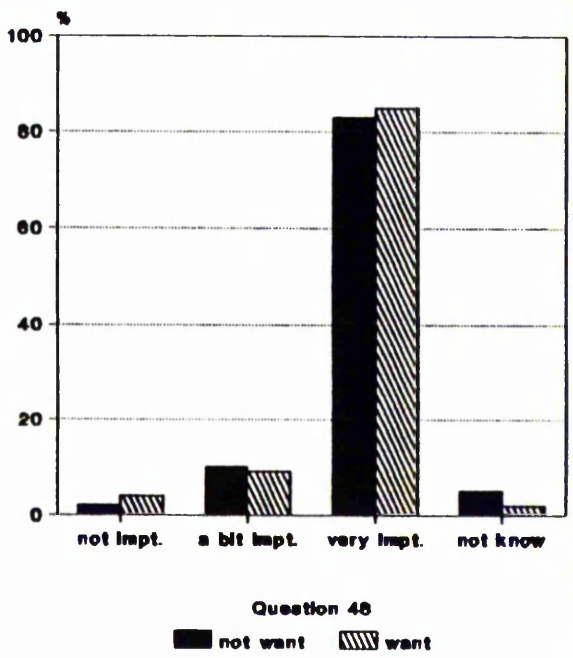

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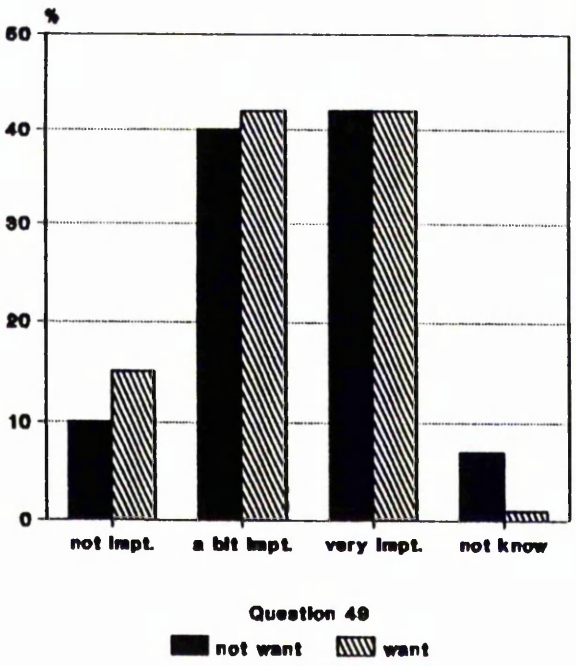

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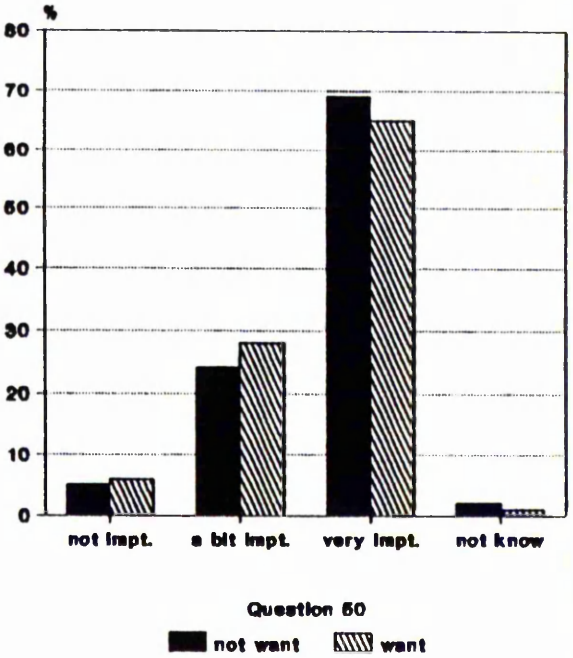

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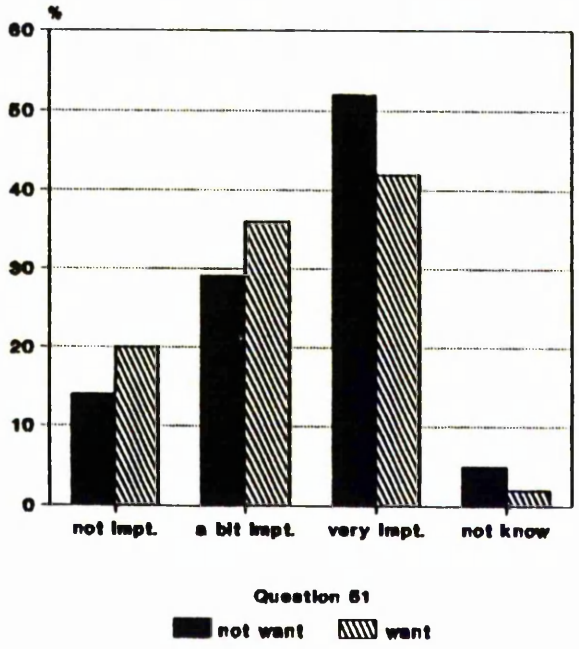

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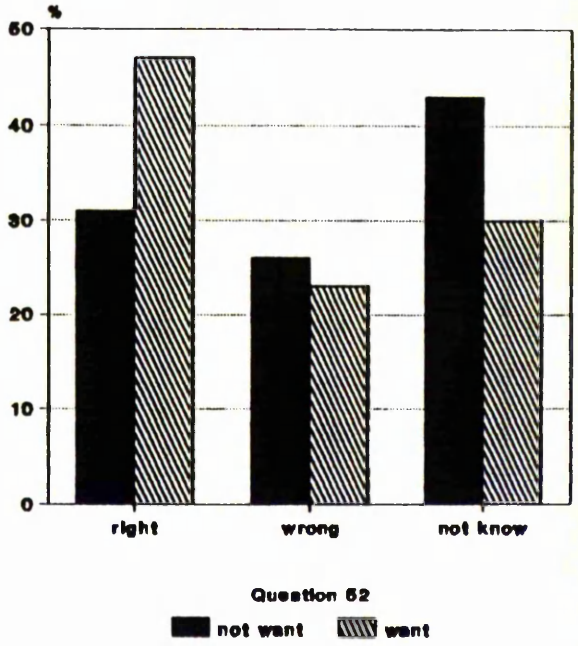

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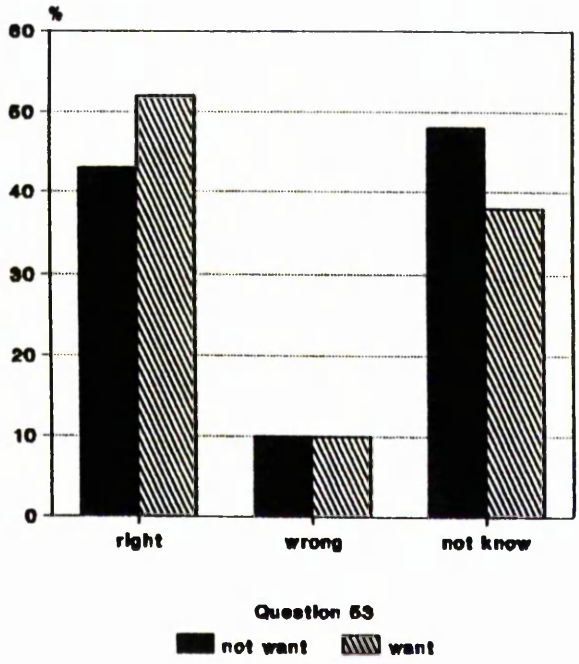

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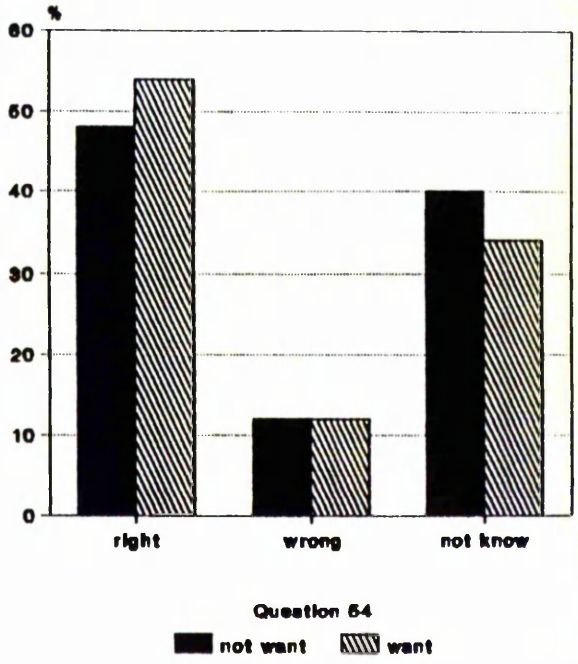

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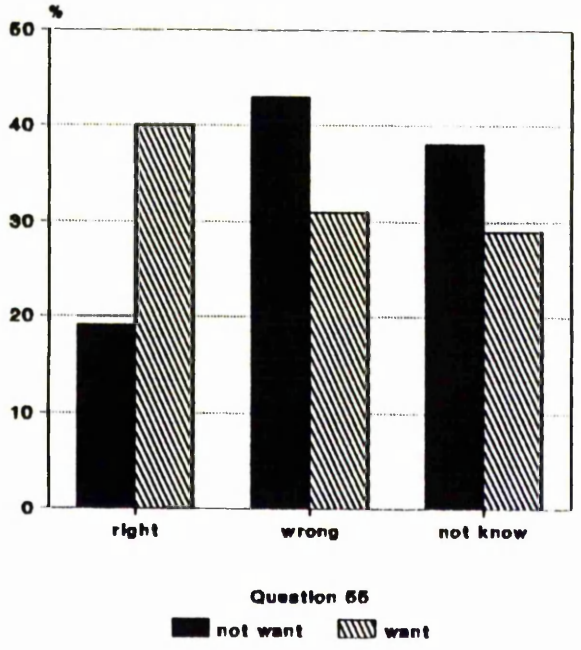

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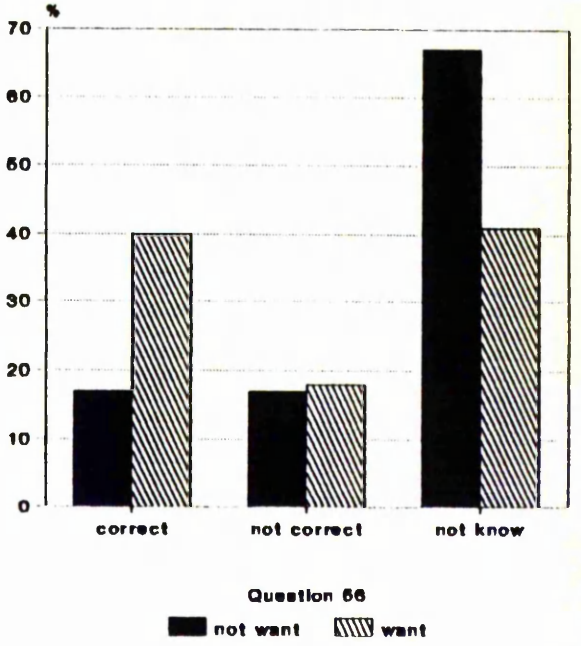

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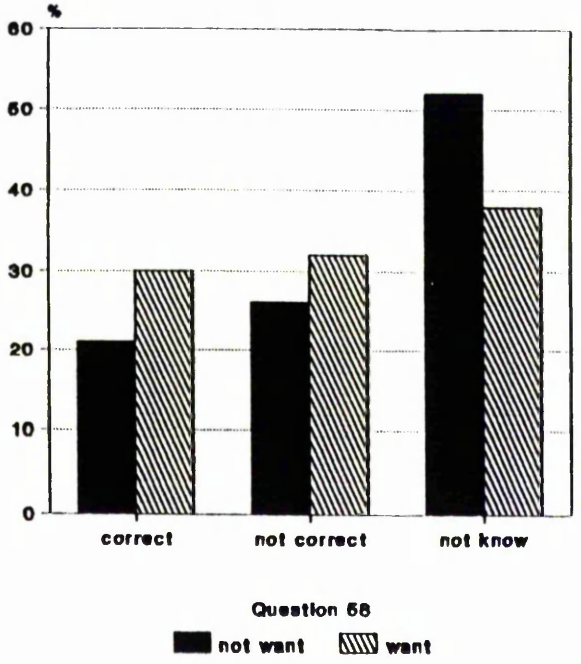

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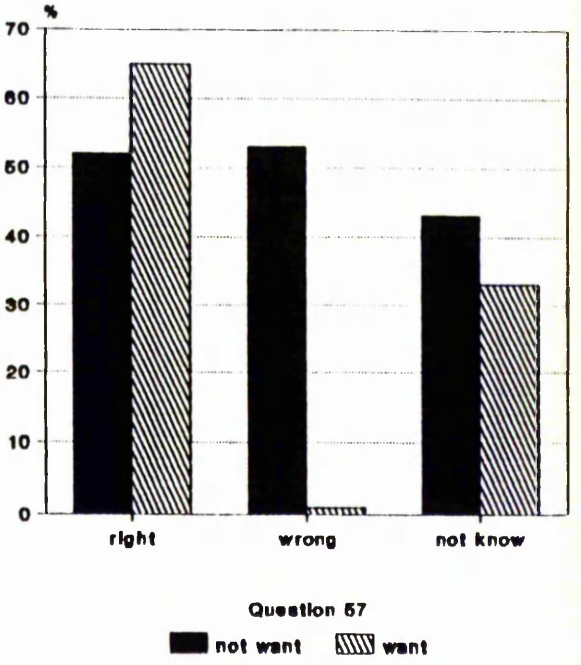

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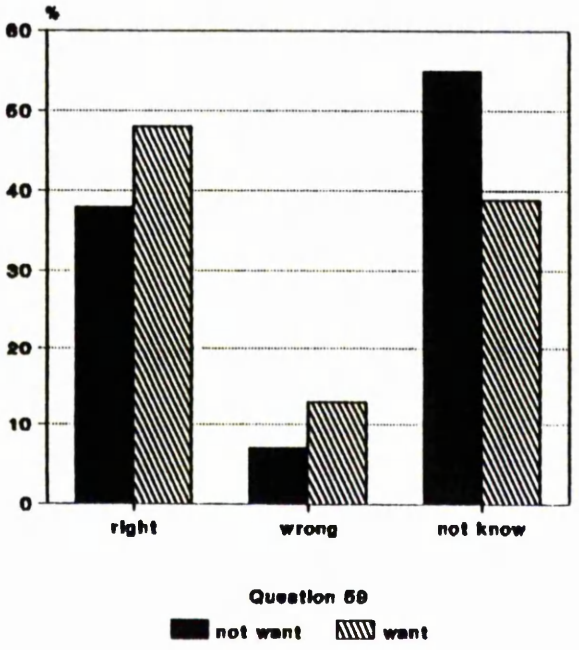

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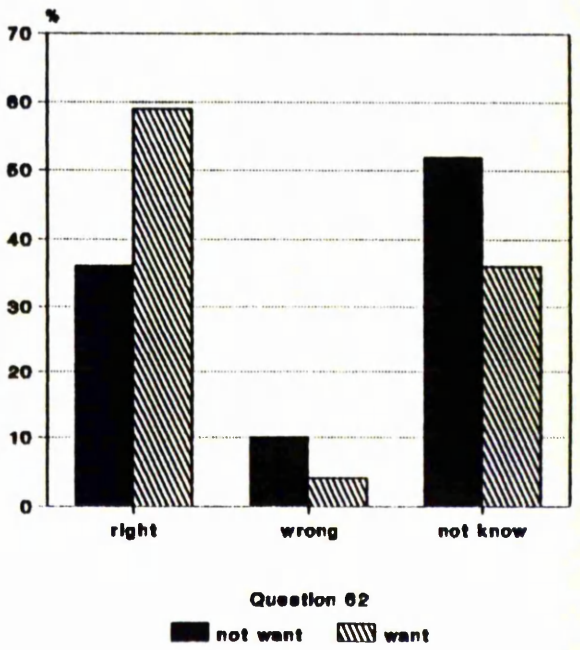

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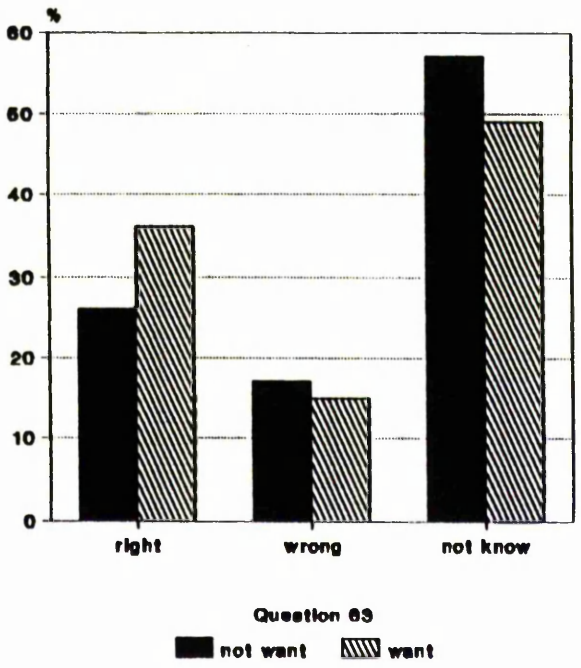

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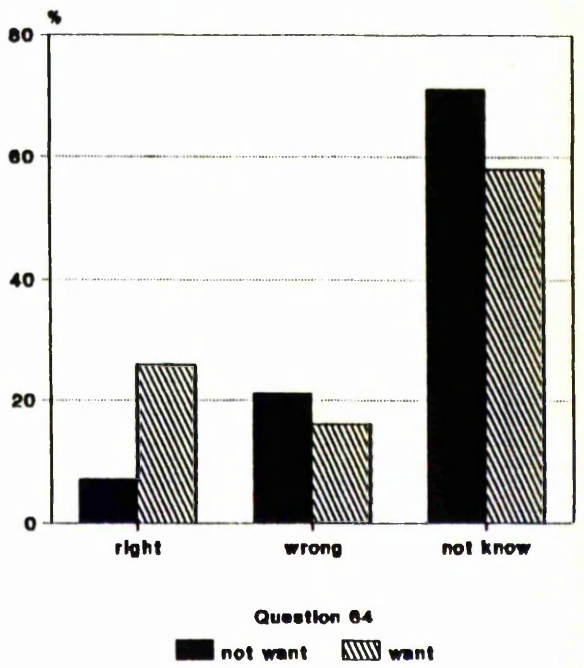

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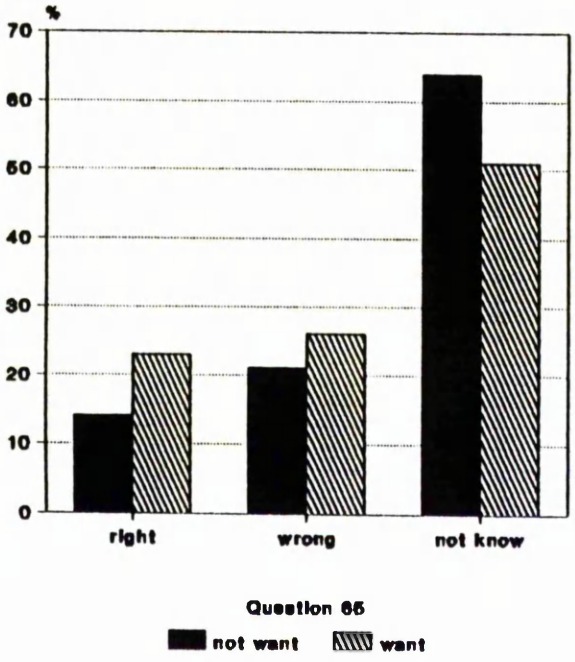

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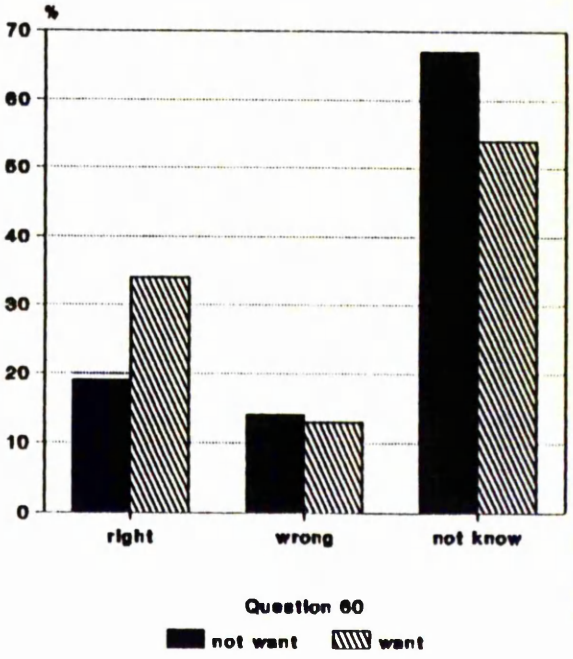

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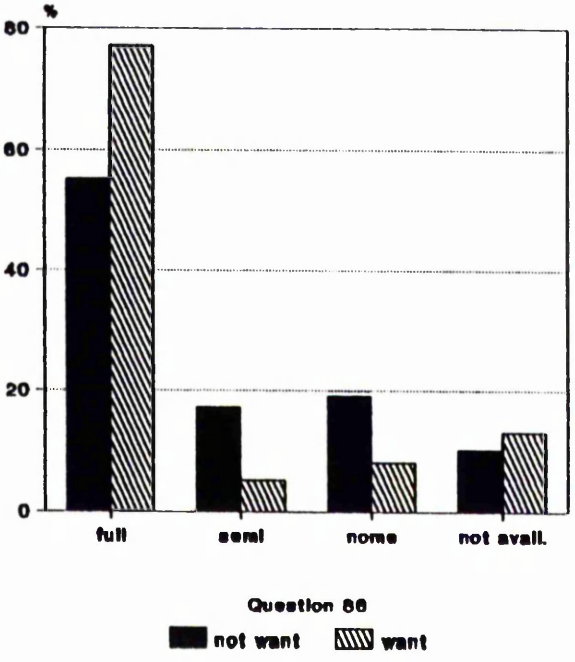

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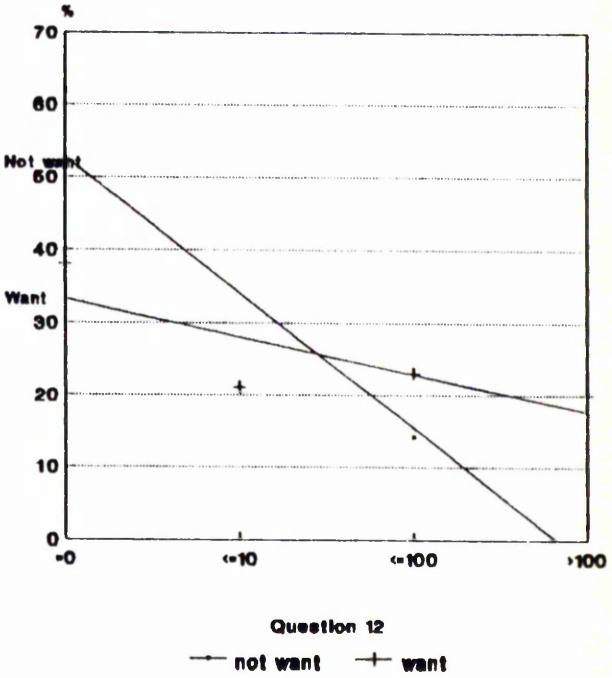

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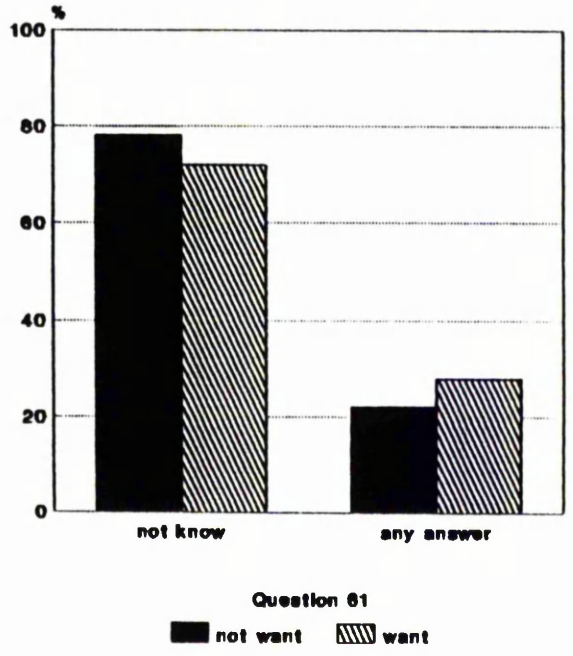

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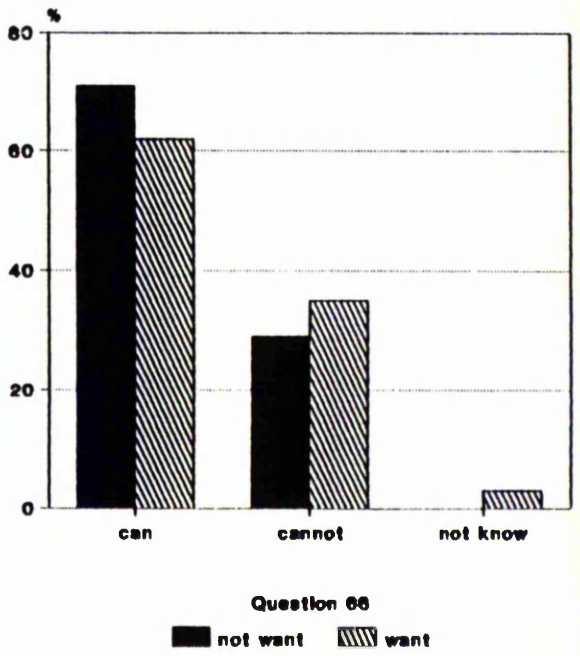

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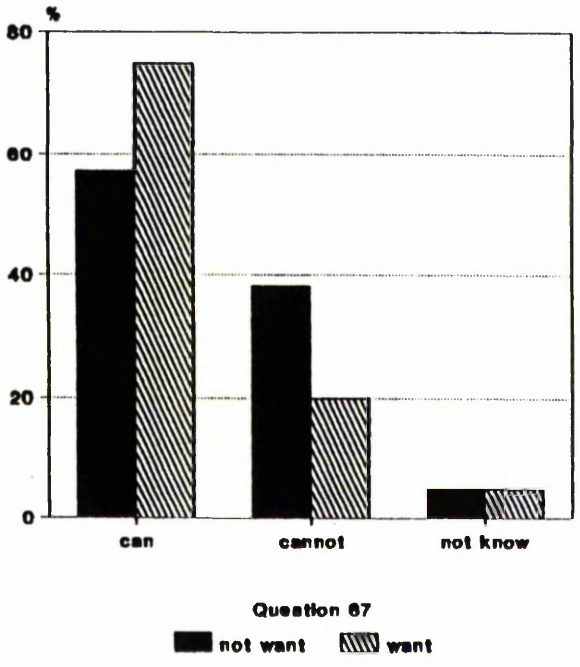

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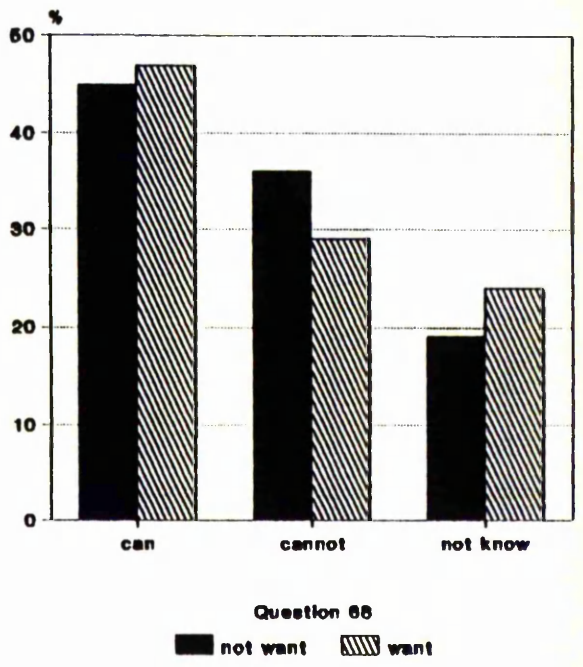

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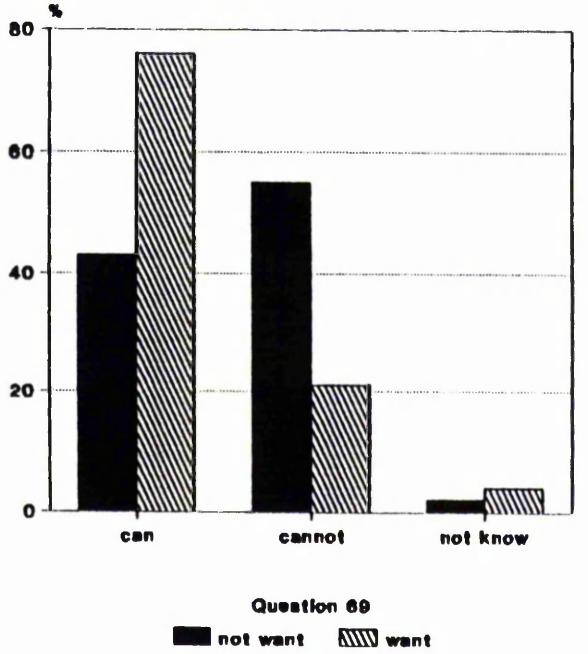

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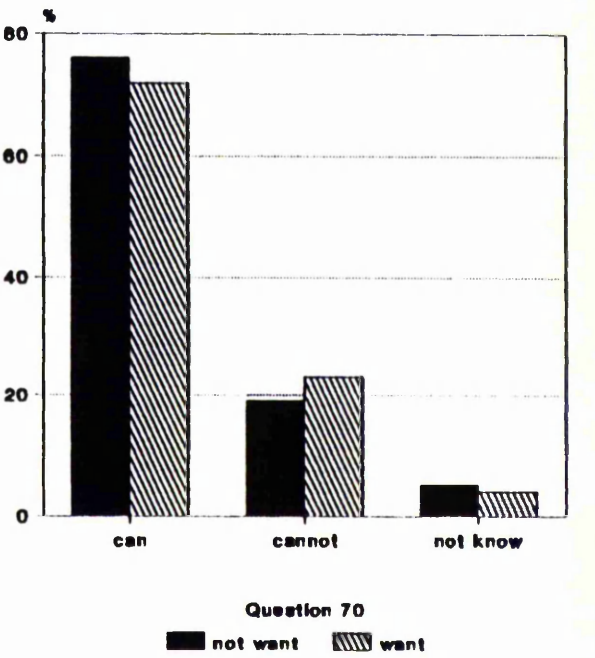

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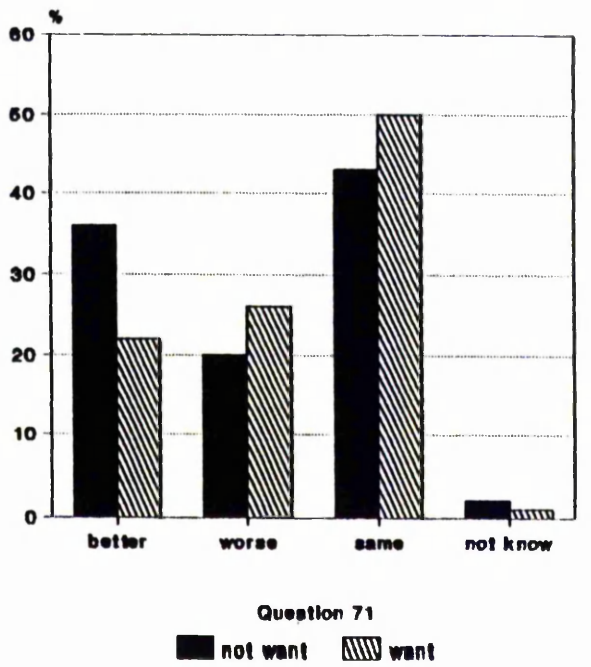

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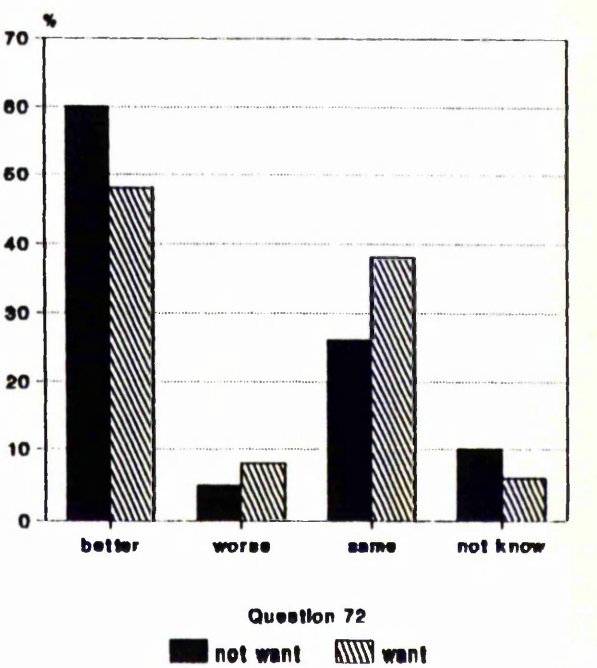

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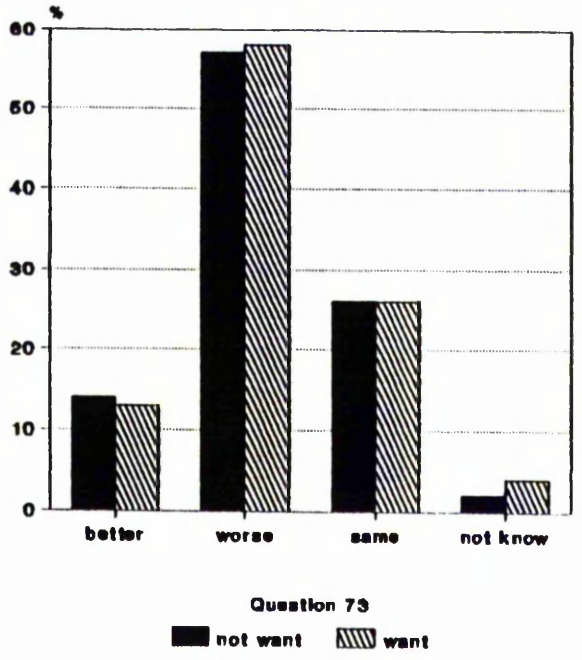

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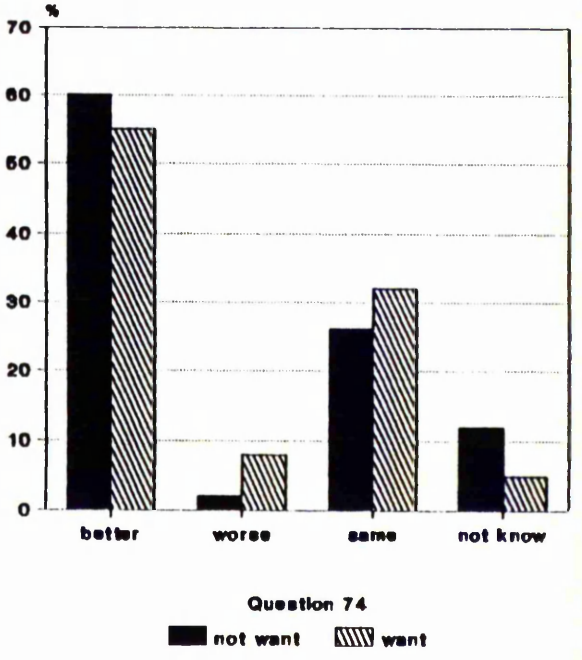

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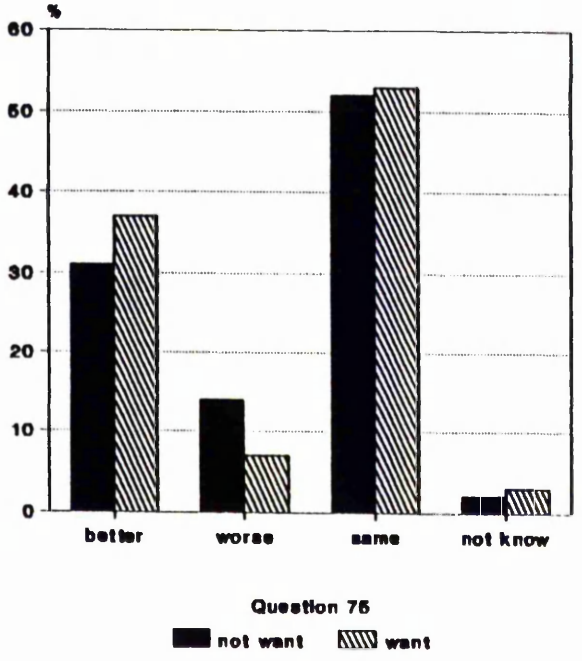

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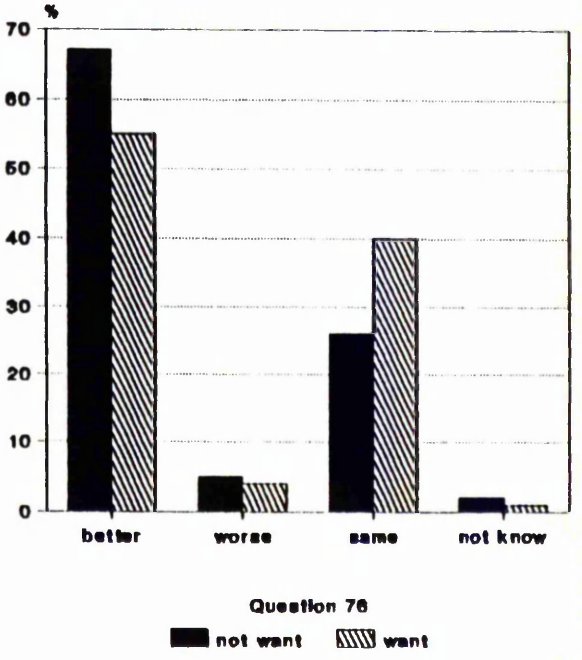

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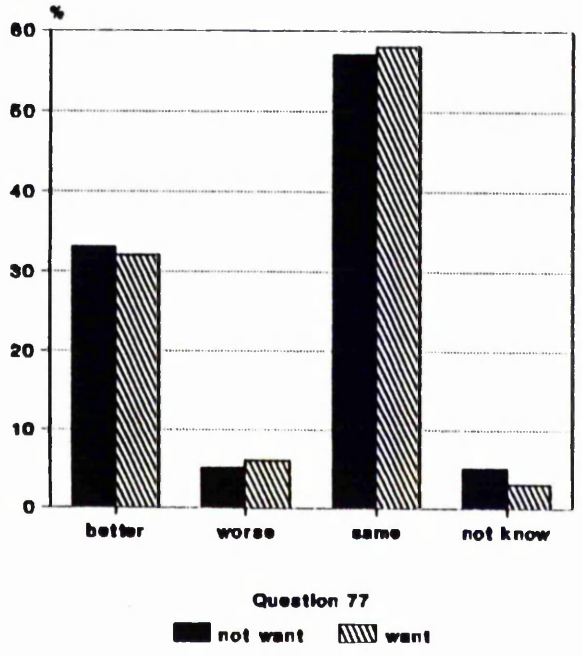

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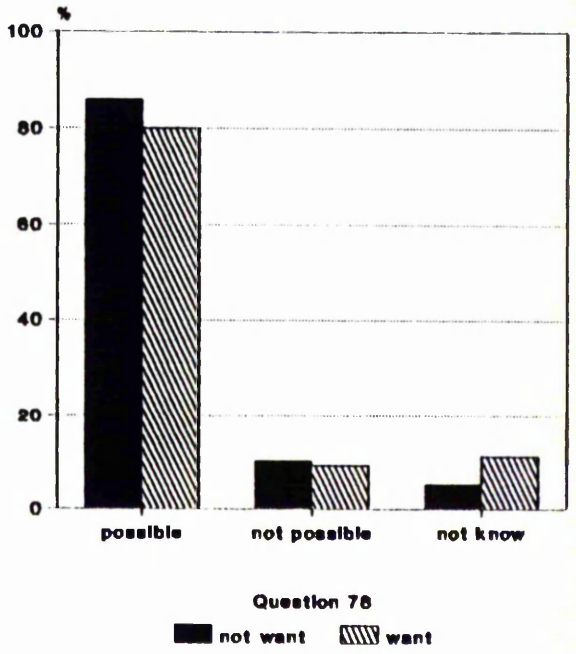

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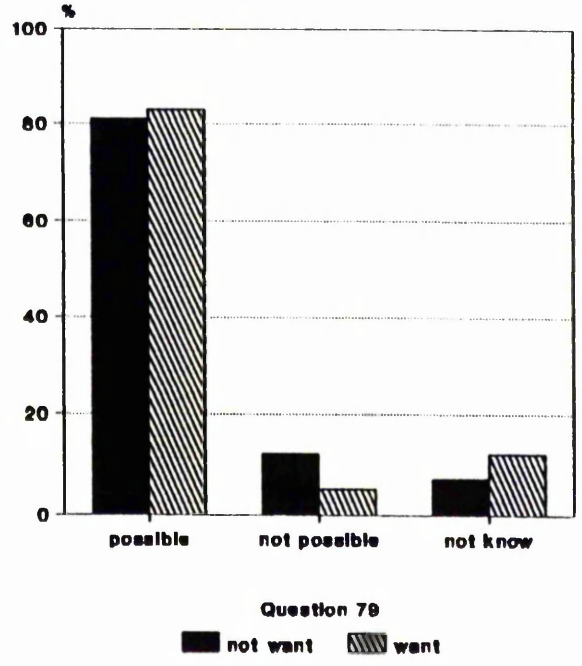

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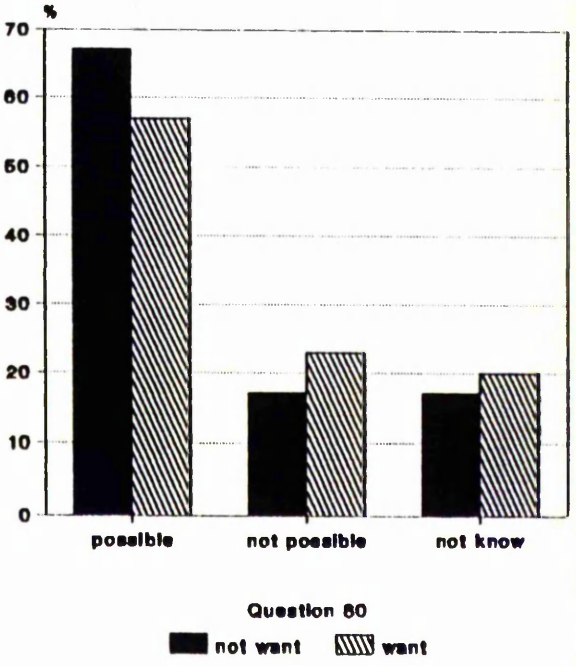

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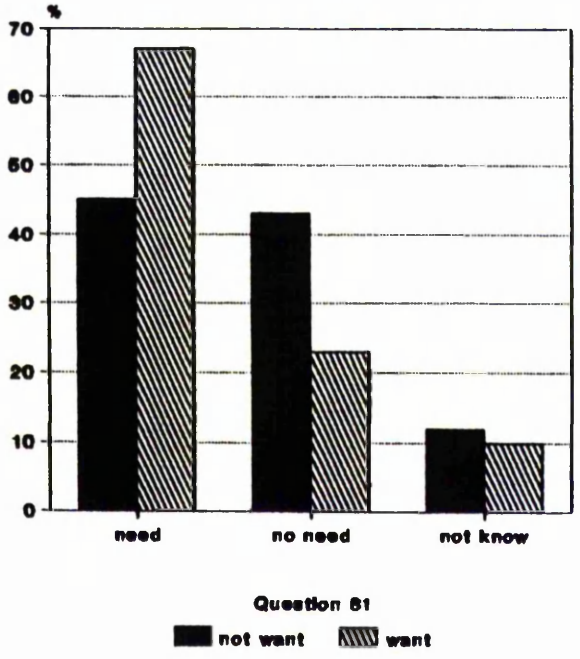

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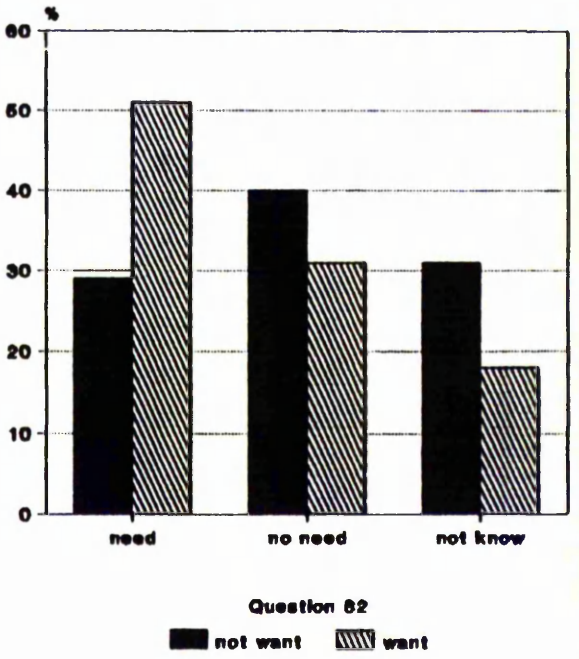

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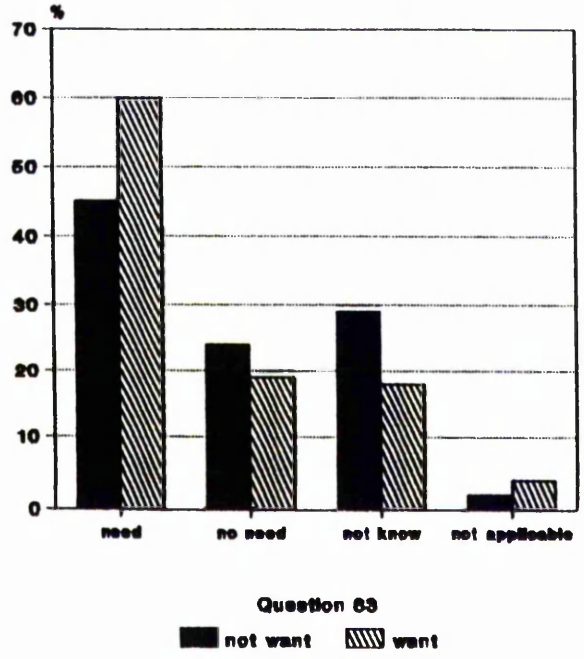

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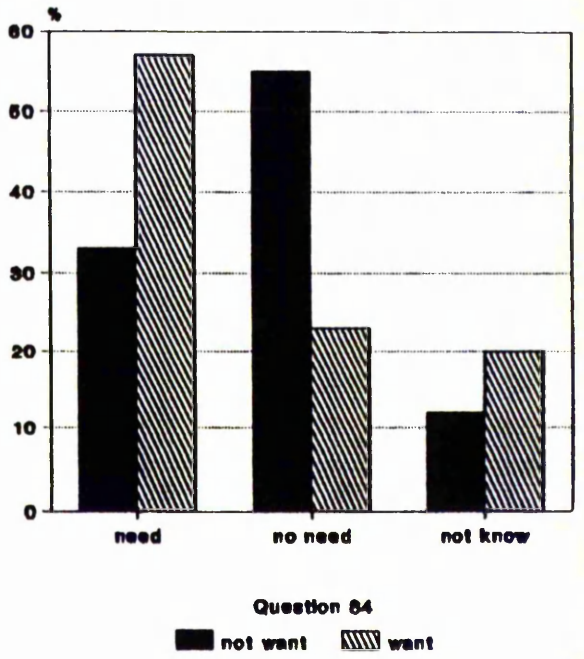

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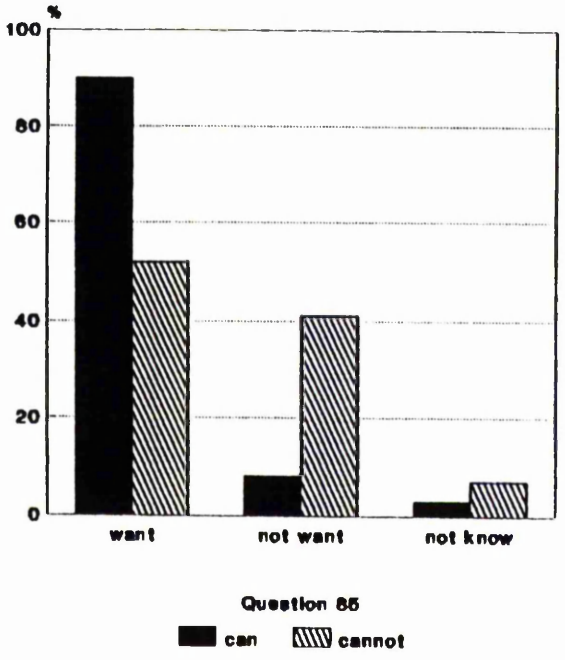

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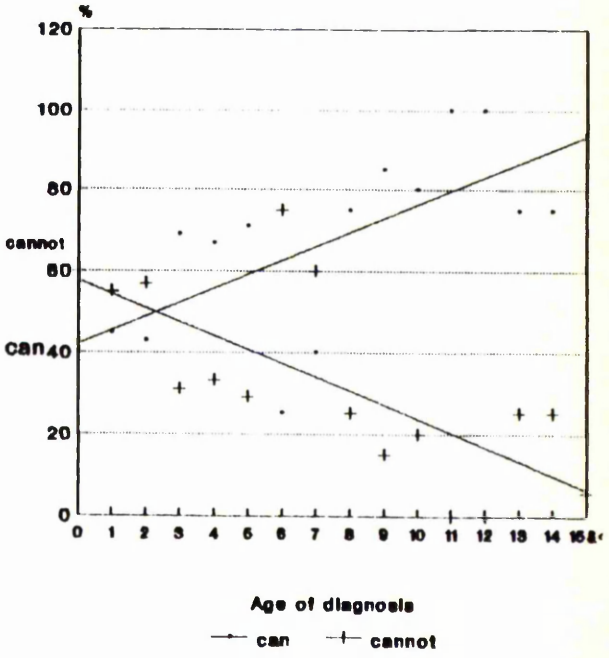

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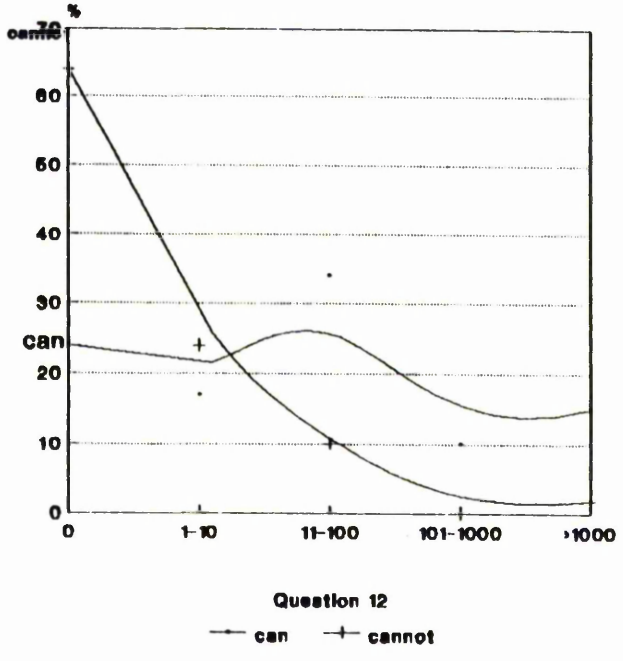

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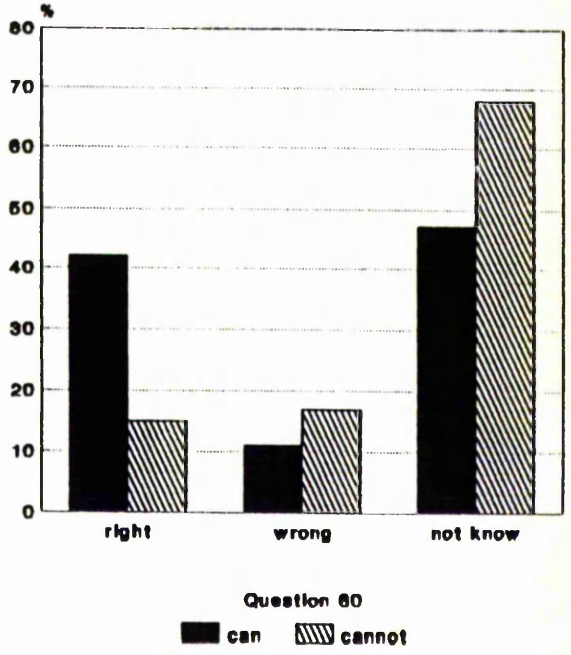

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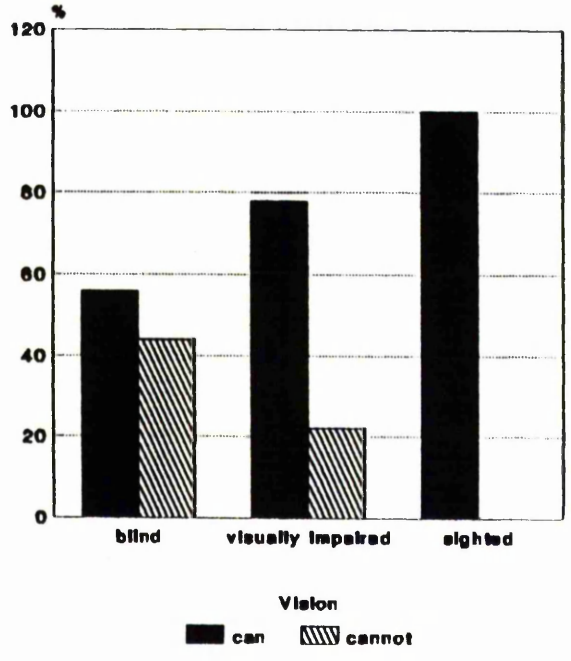

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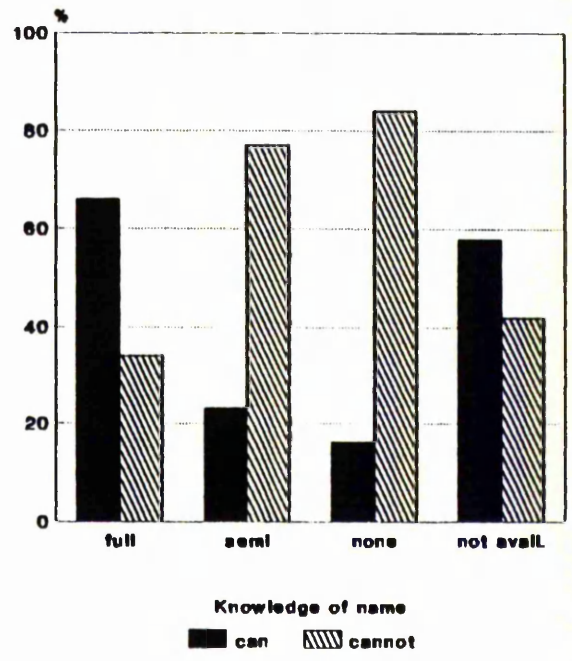

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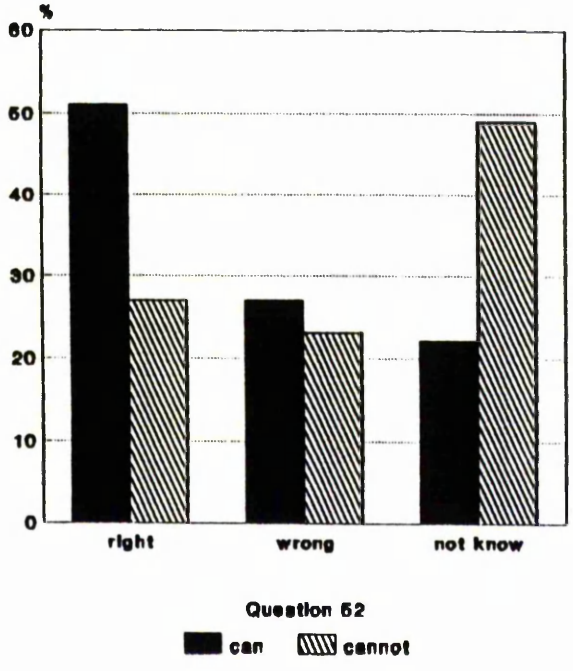

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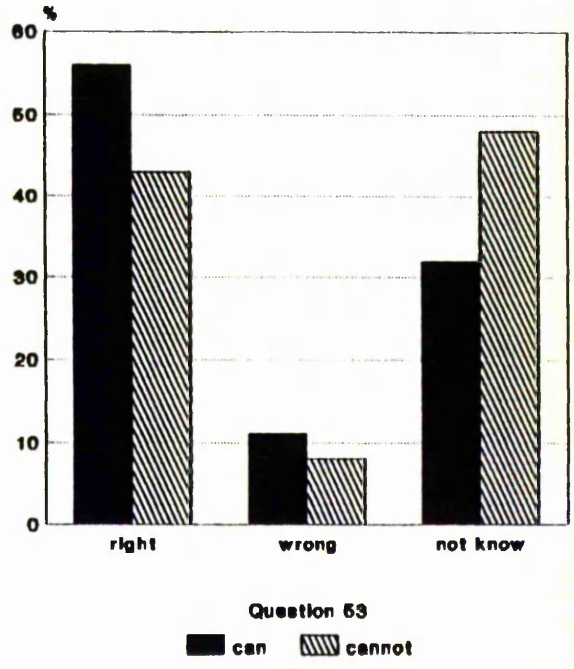

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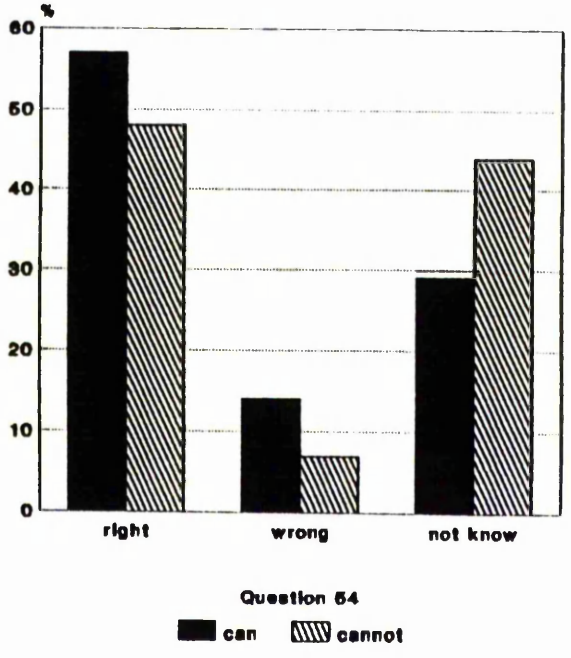

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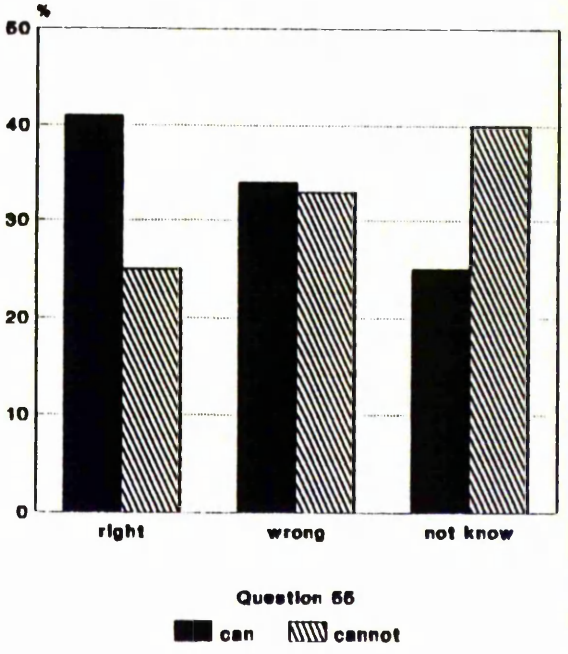

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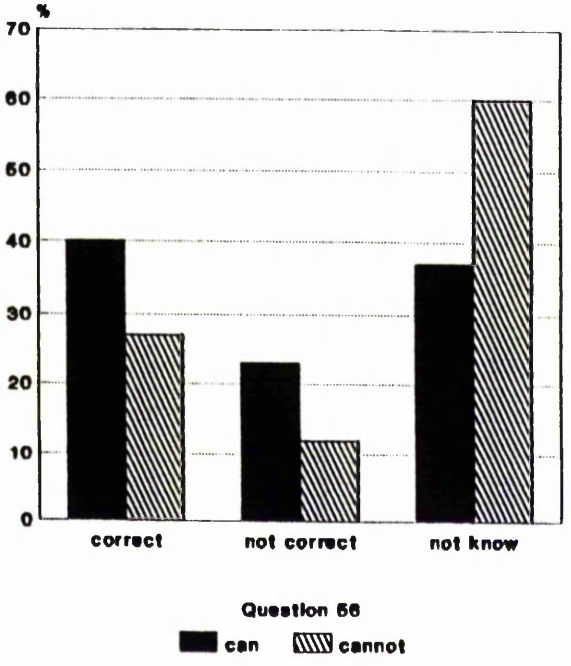

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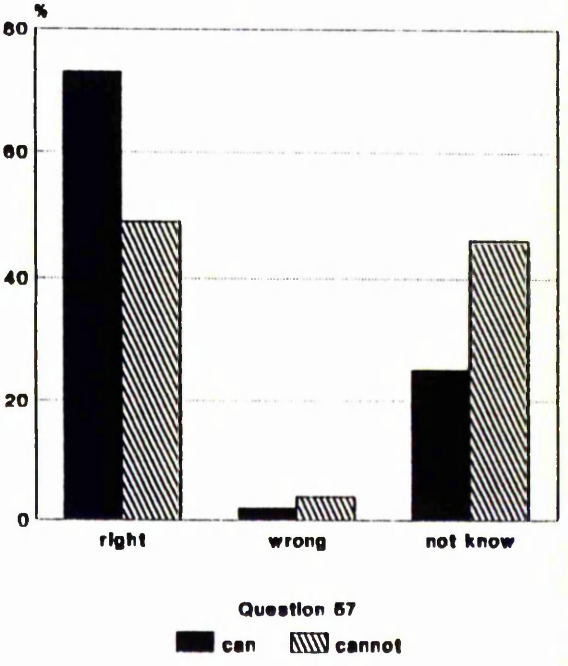

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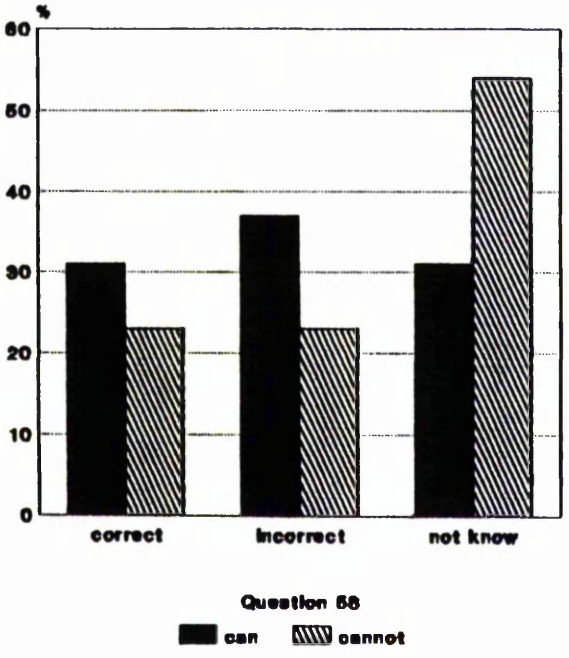

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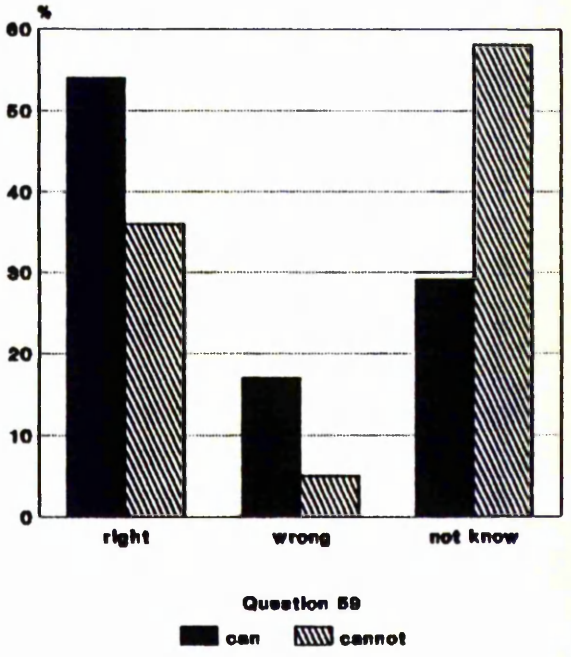

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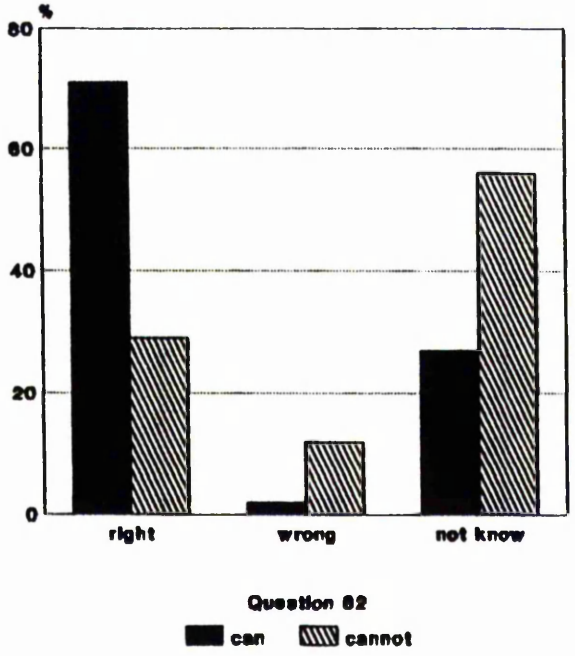

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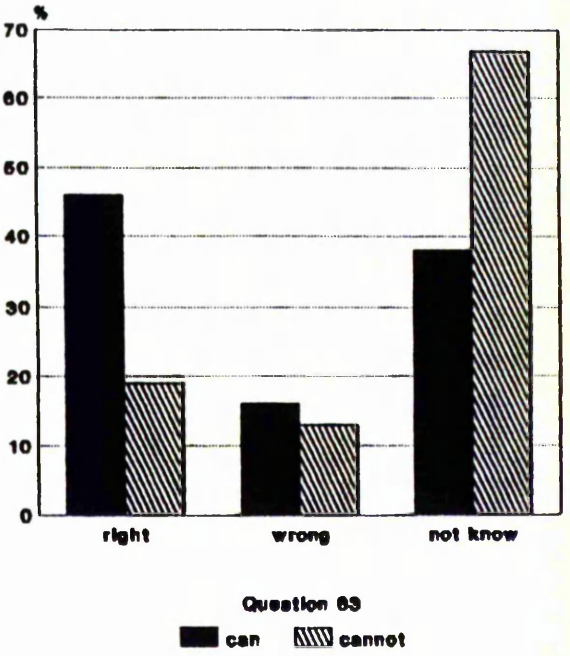

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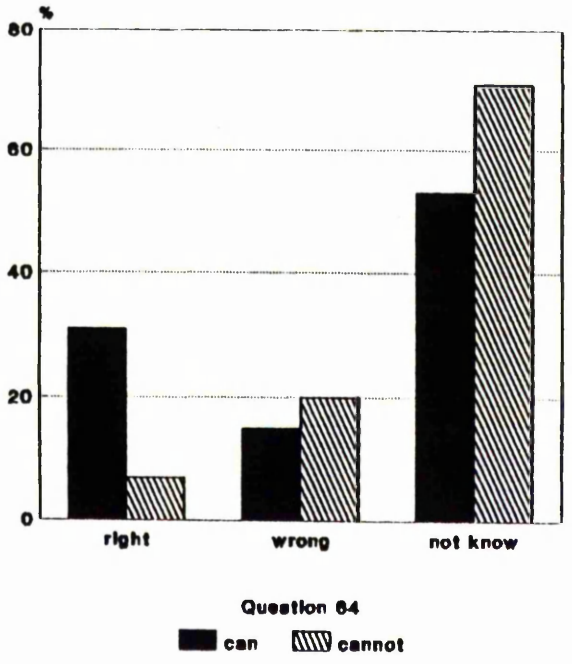
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cannot

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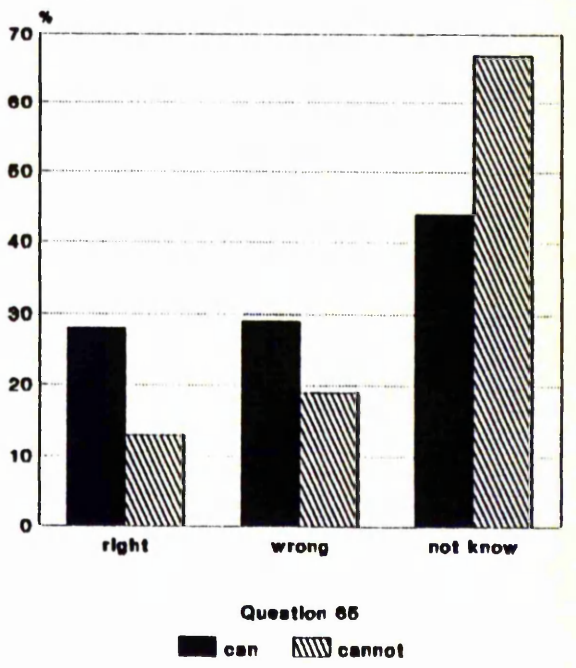
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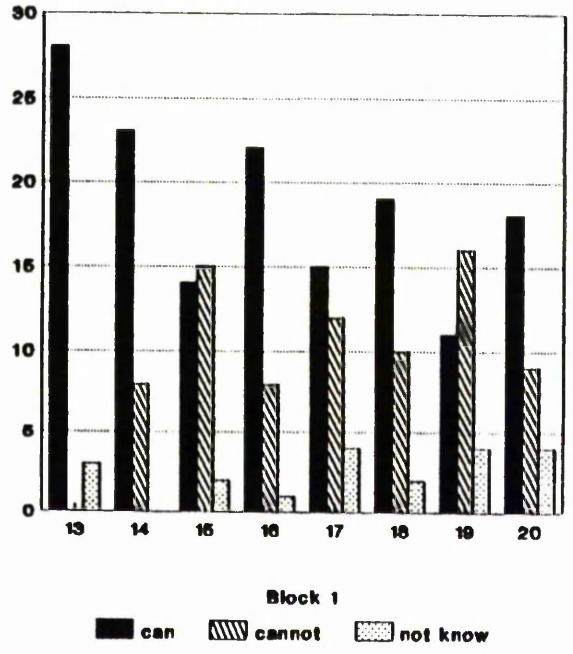

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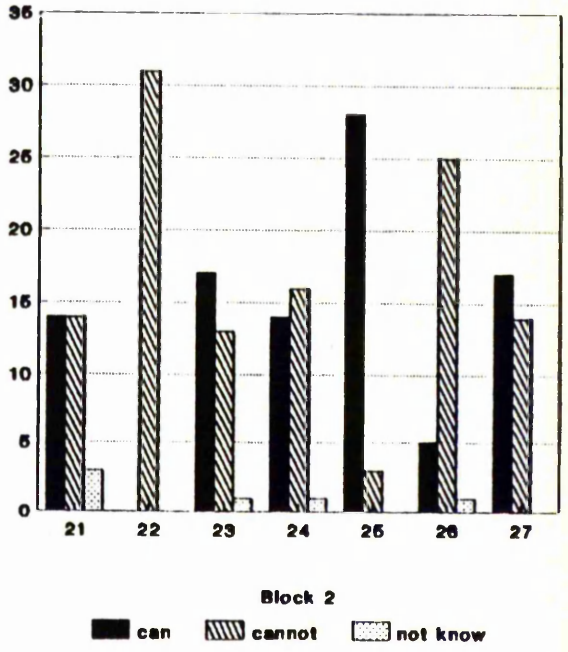

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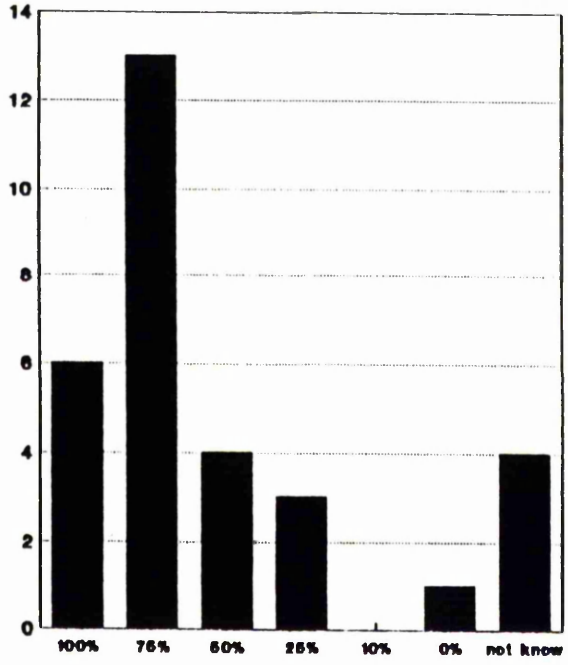

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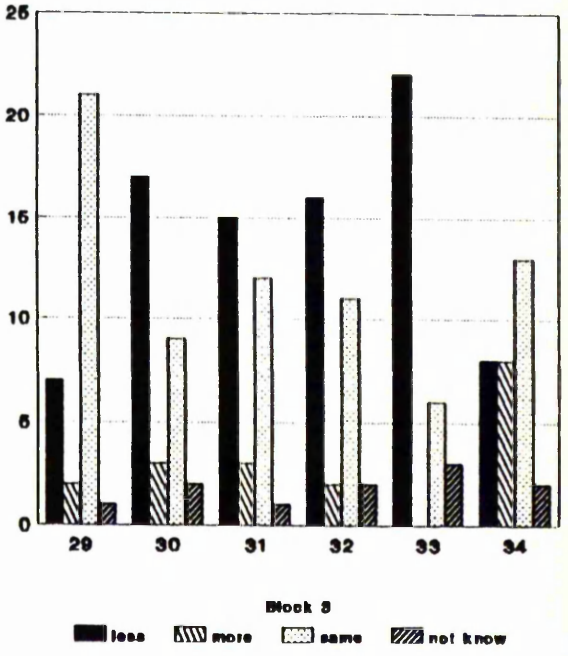

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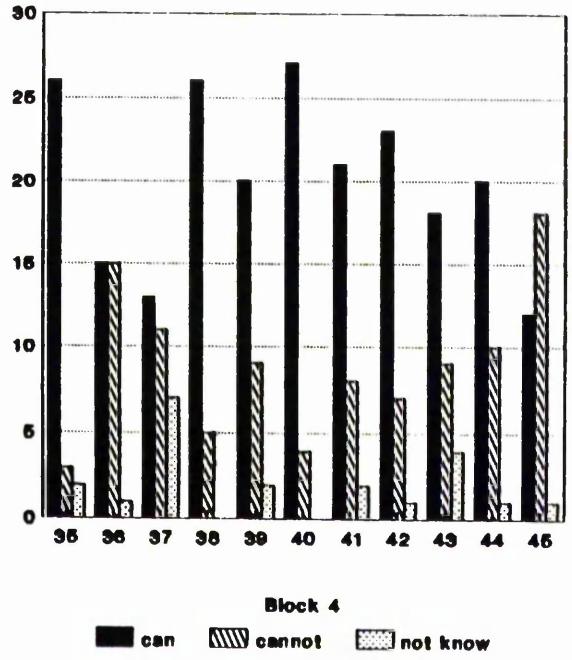

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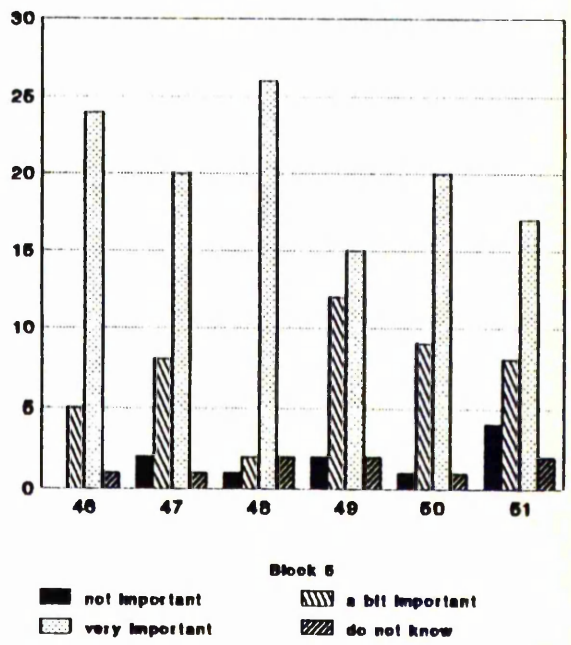

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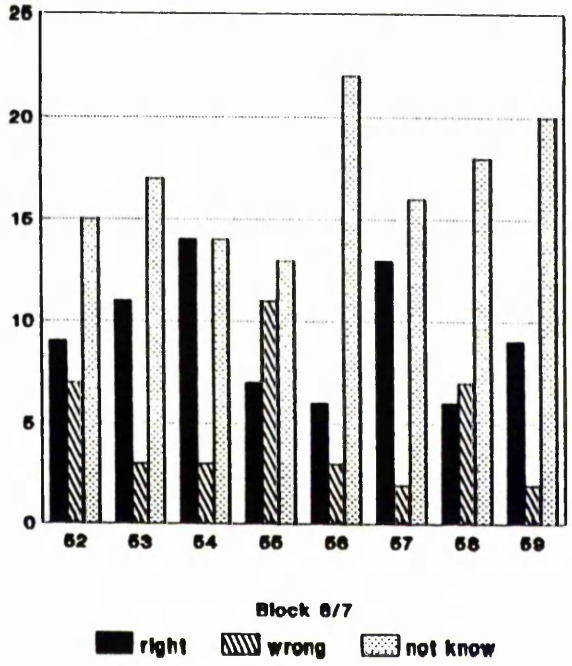

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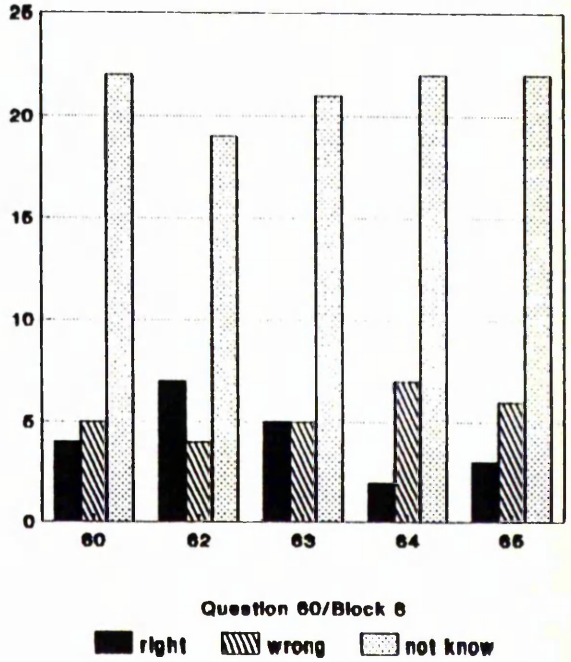
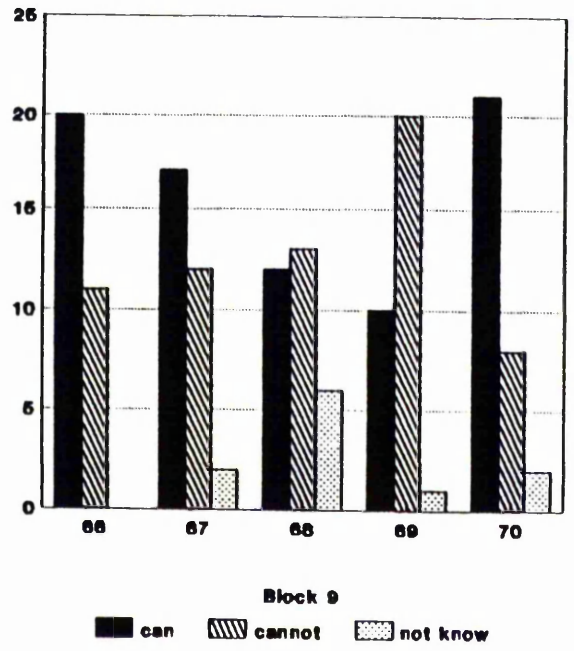


1.5.9



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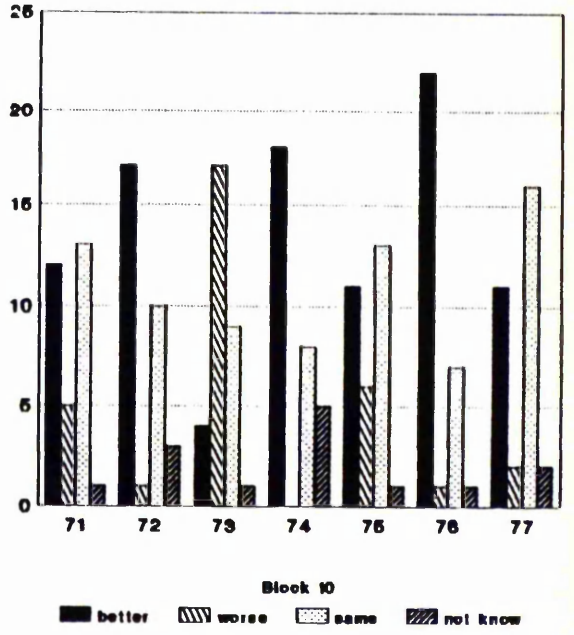

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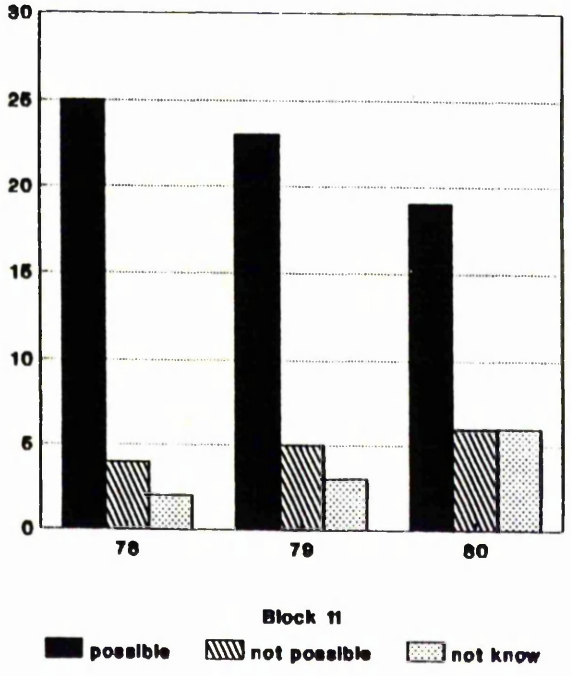

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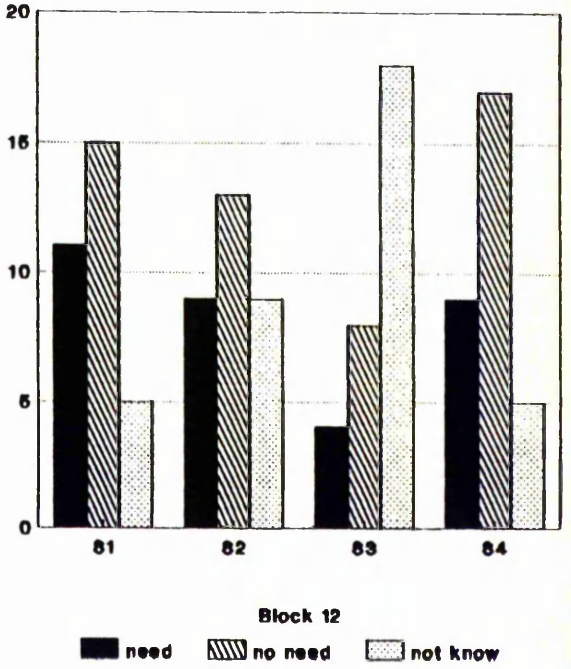

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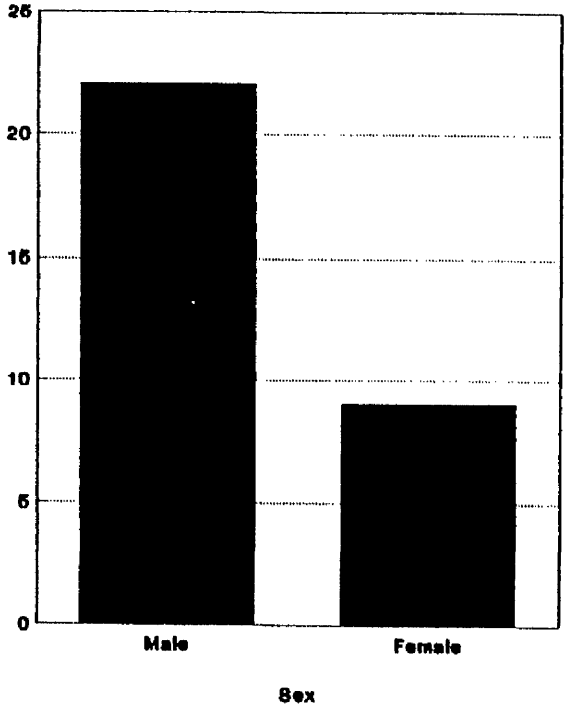

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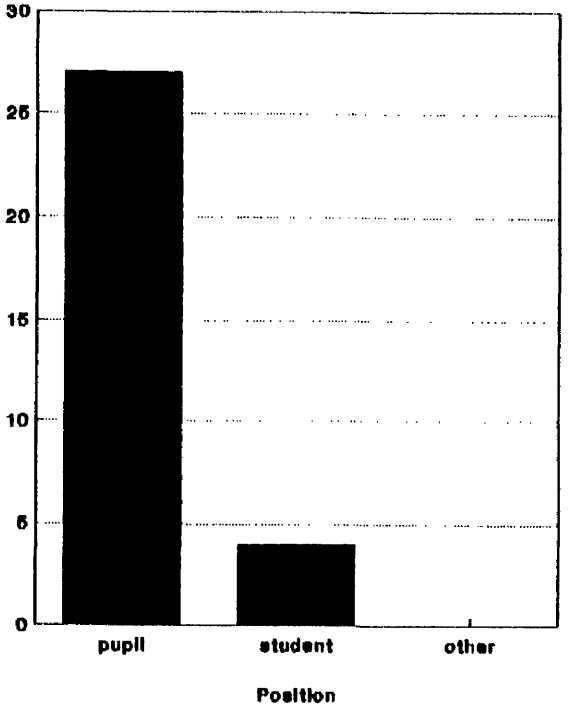

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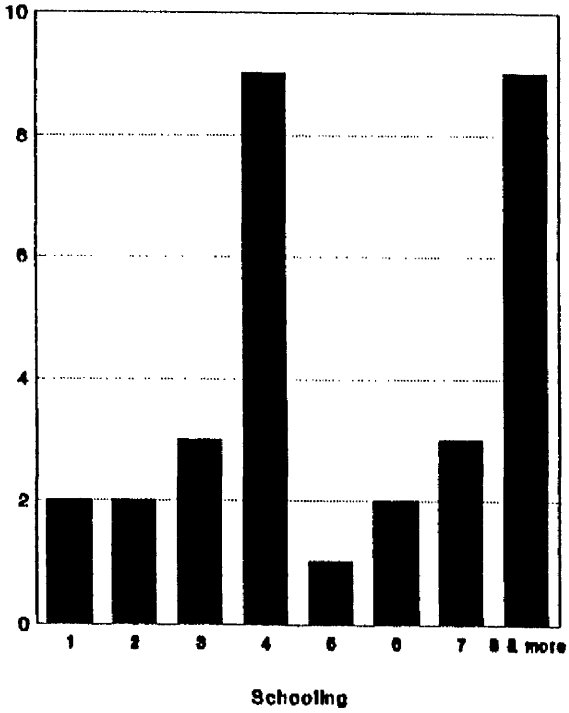

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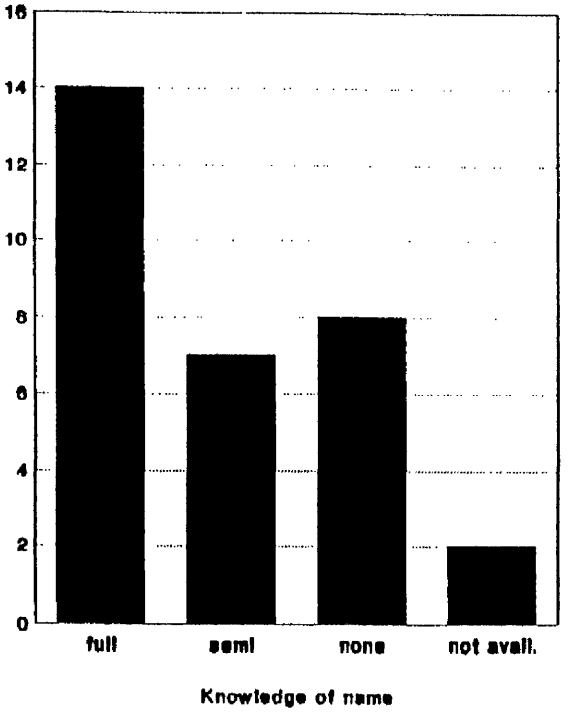
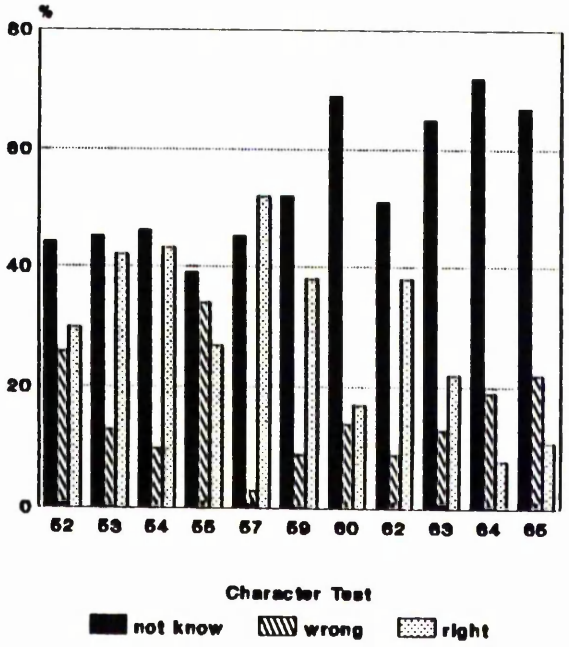


1.6.1



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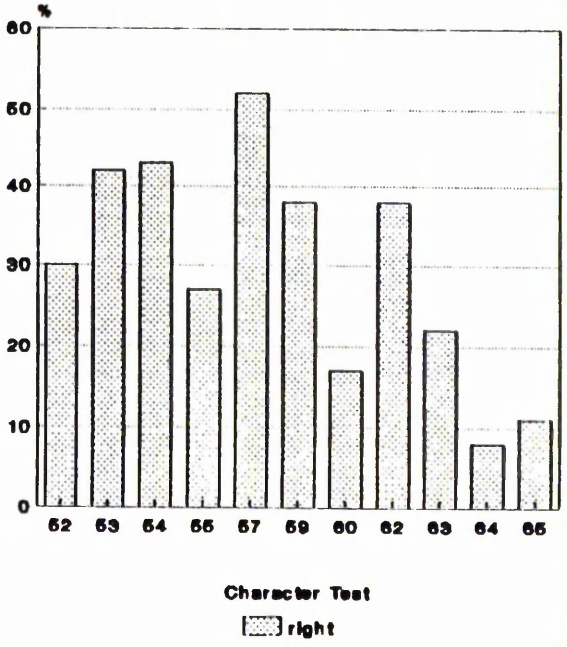

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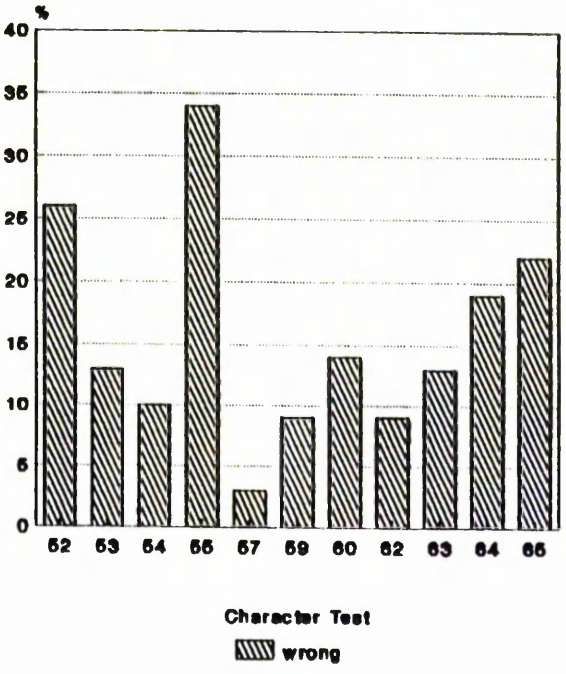

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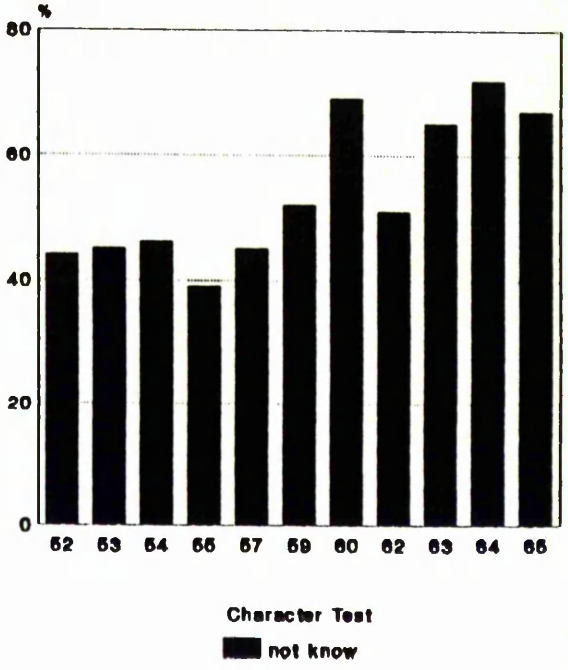


2.1

Questions for semi-structured interviews

The questions were asked by the researcher. The exact wording of the questions varied according to circumstances. The respondents were left to answer in their own time. The respondents had agreed that the interview be audiotaped.

1.) The respondents were first asked to talk about themselves, for example to explain their work.

2.) The respondents were then asked to explain what they considered to be the benefits and the shortcomings of Chinese Braille.

3.) The respondents were then asked to explain what they thought about the possibility of visually impaired persons in China learning Chinese characters.

Only after these three questions were fully answered, were the respondents encouraged to discuss the suggestion of a character Braille system.

2.2 List of Respondents

Visually impaired (37)

Ms Chen Jinchun	(陳錦純)	Committee for the Blind of Taiwan
Ms Chen Shuzhen	( )	Taibei School for the Blind
Ms Liu Ping	(劉平)	Taibei School for the Blind
Ms Wang Hong	(王虹)	Beijing School for the Blind
Ms Zhao Baoqing	(趙保清)	Beijing School for the Blind
Mr Cai Longxiong	(蔡龍雄)	Taibei School for the Blind
Mr Chen Shuimu	( )	Beijing Braille Publish. House
Mr Chong Chanyao *	(莊陳有)	Hong Kong Association of the Blind
Mr Dai Guoxiong	(戴國雄)	Taibei School for the Blind
Dr Steve Fung *	(馮漢源)	Hong Kong University
Mr Fred Leung *	(深洲田)	Hong Kong Society for the Blind
Mr Gan Bolin	(甘柏林)	Chang Chun University
Mr Ha Shexiang	( )	H.K. Christian Lit. for the Blind
Mr Huang Jiani	(黃加尼)	Author of "Dianzi Fuhao Yongfa"
Mr Huang Nai	(黃乃)	Inventor of xianxin mangwen
Mr Lao Hanleung	( )	Hong Kong Association of the Blind
Mr Li Kunwang	(李昆旺)	Committee for the Blind of Taiwan
Mr Li Qingzhong	(李慶忠)	Beijing School for the Blind
Mr Li Renwei	(李任偉)	Beijing School for the Blind
Mr Li Weihong	(李偉洪)	Beijing Braille Publish. House
Mr Li Xusheng	(李序生)	Taibei Shifandaxue
Mr Martin Chow	( )	H.K. Christian Lit. for the Blind
Mr Ruan Chunlong	( )	Taibei School for the Blind
Mr Shang Di	(尚柢)	Tianjin School for the Blind
Mr Teng Weimin	(滕偉民)	China Disabled Persons Federation
Mr Wang Xinchao	(王新潮)	Beijing School for the Blind
Mr Xie Yinzhang	(謝)	Taibei School for the Blind
Mr Xu Bailun	(徐白侖)	Golden Key Center
Mr Ye Yaozeng	( )	Beijing Braille Publish. House
Mr Yuan Jianming	(袁建明)	Hong Kong Association of the Blind
Mr Zhang Wencong	(張文聰)	Taibei School for the Blind
Mr Zhang Yuhao	(張育豪)	Blind's Welfare Association R.O.C.
Mr Zhang Zhuo	(張卓)	Chang Chun University
Mr Zheng Longshui	(鄭龍水)	Blind's Welfare Association
Mr Zheng Rongchen	(鄭榮臣)	Tianjin School for the Blind
Mr Zhou Youguang	(周有光)	State Language Commission, PRC

Sighted (23)

Ms Chang Xuelan	(常學蘭)	Tianjin School for the Blind
Ms Deng Mindai	(鄧敏帶)	Nanning School for the Blind
Ms Gong Yun	(龔云)	Tianjin School for the Blind
Ms Guo Baoxian	(郭宝賢)	Beijing School for the Blind
Ms Han Ping	(韓苹)	Beijing School for the Blind
Ms Li Guisheng	(李貴生)	Tianjin School for the Blind
Ms Yan Boqin	(晏波琴)	Tianjin School for the Blind
Ms Yiu Yukwah *	(姚玉樺)	Ebenezer School for the Blind
Ms Yuan Xiaofen	(袁小分)	Ebenezer School for the Blind
Ms Zhou Lingheng *	(周憐姮)	Committee for the Blind of Taiwan *
Ms Zhu Muzhen	(諸幕珍)	Ebenezer School for the Blind
Mr Fu Yonghe	(傅永和)	State Language Commission, PRC
Mr Gao Xu	(高旭)	Beijing Braille Publish. House
Mr Guo Xijun	(郭璽鈞)	Tianjin School for the Blind
Mr Huo Yougang	(候右罡)	Tianjin School for the Blind
Mr Liu Yanhua	(劉岩華)	Beijing School for the Blind
Mr Mao Yuhang	(茅于杭)	Qinghua University
Mr Qian Li	(潛力)	Beijing School for the Blind
Mr Shi Zhangchao	(石長超)	Beijing School for the Blind
Mr Xu Jingfu	(徐景福)	Chang Chun University
Mr Zhang Kemin	(張克敏)	Beijing School for the Blind
Mr Zhang Tiantang	(張添唐)	Taibei School for the Blind

Interviews untaped (5)

Director of Taibei School for the Blind.
Director of Beijing School for the Blind.
Director of Ebenezer School for the Blind.
Director of Nanning School for the Blind.
Teacher at Guangzhou School from the Blind.
Administrator of Commitee for the Blind of Taiwan.

3.1 Material used in the experimental introduction of Prototype 1 Chinese Character Braille

The following Chinese texts are written in *jiantizi*. The dictionaries provided in the experiment were also available ordered according to pronunciation and with the pronunciation written in first place per entry. Since the order remains the same however in this prototype only one dictionary is reproduced here.

All texts are also printed out in the ASCII code for the Braille version.

3.1.1 Text 1

在桌子上有一本书.

书里有四个课文.

宁宁看书.

课文里有汉字.

宁宁学习汉字.

字典

在 – zai 4 : 存在于某地点："书在桌子上呢".

桌 – zhuo 1 : 桌子：一种日用的家具,上面可以放东西.

子 – zi 3 : 古代指儿女,现在专指儿子.

上 – shang 4 ; 位置在高处的,跟"下"相反.

有 – you 3 : 跟"无"相反,表所属：他有一本书.

一 – yi 1 : 数目字.

本 – ben 3 : 草木的根,跟末相反：无本之木.

书 – shu 1 : 成本的著作.

里 – li 3 : 里面,内部,跟外相反：屋子里.

四 – si 4 : 数目字.

个 – ge 4 : 量词.

课 – ke 4 : 功课,有计划的分段教学：上课.

文 – wen 2 : 文字,记录语言的符号：甲骨文,外文.

宁 – ning 2 : 安宁,南京市的别称.

看 – kan 4 : 瞧,瞅,：看书,看电影.

汉 – han 4 : 朝代名,汉族：我国人数最多的民族.

字 – zi 4 : 文字,用来记录语言的符号:汉字.

学 – xue 2 : 学习,活到老,学到老.

习 – xi 2 : 学过后再温熟,反复地学使熟练:自习,复习.

词典

桌子 – 家具,上有平面,下有支柱,在上面放东西或做事情:一张桌子.

课文 – 教科书中的正文.

宁宁 – 名字.

汉字 – 记录汉语的文字.

学习 – 从阅读,听讲,研究,实践中获得知识或技能:学习文化.

3.1.2 Text 2

晚上七点钟，宁宁开始复习。他复习生词，念课文，写汉字。丽丽也复习。她从桌子里拿出来一本书，坐在椅子上看。她看得非常認真。

字典

晚 – wan 3 ; 太阳落了的时候：从早到晚。

七 – qi 1 ; 数目字。

点 – dian 3 ; 1少量，2汉字的一种笔形。

钟 – zhong 1 ; 指钟点，时间：二点钟。

开 – kai 1 ; 1起始，2把关闭的东西打开。

始 – shi 3 ; 开始，起头，最初：开始报告。

复 – fu 4 ; 回去，返：翻来复去。

他 – ta 1 ; 称你，我以外的第三人，一般指男性。

生 – sheng 1 ; 出生，诞生：生辰。

词 – ci 2 ; 在句子里能自由运用的最小的语言单位。

念 – nian 4 ; 诵读：念书。

写 – xie 3 ; 写字的 “写“。

丽 – li 4 ; 好看，漂亮：美丽。

也 – ye 3 ; 副词，表示同样，并行等意义：你去，我也去。

从 – cong 2 ; 自，由：从南到北。

拿 – na 2 ; 用手取，握在手里：拿笔。

出 – chu 1 ; 跟 “入“，“进“ 相反。

来 － lai 2 ； 由另一方面到这一方面，跟“去“，“往“相反。

坐 － zuo 4 ； 坐位的“坐“：坐在凳子上。

椅 － yi 3 ； 椅子，有靠背的坐具。

她 － ta 1 ； 称你，我以外的女性第三人。

得 － de ； 用在动词或形容词后连接表结果或程度的补语：跑得快。

非 － fei 1 ； 跟“是“相反。

常 － chang 2； 平常，普通的，一般的。

認 － ren 4 ； 分辨，识别：识字。

真 － zhen 1 ； 真实，跟客观事物相符合，跟“假“相反。

词典

晚上 － 太阳落了以后到深夜一前的时间，也泛指夜里。

开始 － 从头起，从某一点起：新的一年开始了。

复习 － 把下过的东西再学习，使巩固。

生词 － 不認识的词。

丽丽 － 名字。

椅子 － 有看靠背的坐具。

非常 － 十分，极，非常光榮。

認真 － 严肃对待，不马虎：認真学习。

3.1.3 Text 3

看书的时候，书上的字不可能个个都認识。如果知道某个字的拼音和声调，忘了怎么写，或者知道发音，可是不知道它的意思，就可以用字典。如果遇到生词，不会读，也不知道意思，也可以用词典.

字典

时 – shi 2 ; 时间，一切物质不断变化或发展所经历的过程.
候 – hou 4 ; 时节：时候.
的 – de ; 在词或语后表明形容词性：伟大的.
不 – bu 4 ; 否定词，表示否定的意义：他不来.
可 – ke 3 ; 可能：能够有实现的条件：这个计划可能提前实现.
能 – neng 2 ; 能力，才干，本事：各尽其能.
都 – dou 1 ; 全，完全：工作不论大小，都要做好.
识 – shi 2 ; 知道，認得，能辨别：识字.
如 – ru 2 ; 如果，假若，假使：如不同意，可提意见.
果 – guo 3 ; 果子，果实，某些植物花落后含有种子的部分：水果.
知 – zhi 1 ; 知道，晓得，明了：知无不信.
道 – dao 4 ; 道儿，路：火车道.
某 – mou 3 ; 代替不明確指出的人，地，事，物等用的词：某人.
拼 – pin 1 ; 连合，凑合：东拼西凑.
音 – yin 1 ; 声：口音.

和 — he 2 ; 连词，跟，同：我和他意见相同．

声 — sheng1 ; 声音，物体振动时所产生的能引起听觉的波：声如洪钟．

调 — diao 4 ; 语言中字音的声调．

忘 — wang 4 ; 忘记，不记得．

了 — le ; 放在动词或形容词后，表示动作或变化已经完成：买了一本书．

怎 — zen 3 ; 疑问词，如何：怎样？

么 — me ; 词尾：怎么．

或 — huo 4 ; 或者，也许，表示不定的词：或远或近．

者 — zhe 3 ; 代词，多指人．

发 — fa 1 ; 表达，说出：发言．

是 — shi 4 ; 表示解释和分类：他是工人．

它 — ta 1 ; 他专指事物．

意 — yi 4 ; 意思，心思：同意．

思 — si 1 ; 想，考虑，动脑筋：做事要三思．

就 — jiu 4 ; 凑近，靠近：就着灯光看书． 表示肯定语氣的词．

以 — yi 3 ; 用，拿，把，将：以少胜多．

用 — yong 4 ; 使用，使人，物发挥其功能：用电．

典 — dian 3 ; 可以作为标准，典范的书籍：典籍。

遇 — yu 4 ; 相逢，会面，碰到：遇雨．

到 — dao 4 ; 达到，到达：到北京．

会 — hui 4 ; 能：表示懂得怎样做或有能力做：他会游泳．

读 — du 2 ; 依照文字念：宣读．

词典

时候 — 时间：现在是什么时候了．

可能 — 表示可以实现：可能性．

認识 — 能够確定某一人或事物是这个人或事物而不是别的：我認识他．

如果 — 连词，表示假设：你如果有困难，我可以帮助你．

知道 — 对于事实或道理有認识：你的意思我知道．

拼音 — 把两个或两以上的音素结合起来成为一个复合的音。拼音文字：用符号来表示语言的的文字．

声调 — 音调，字调．

怎么 — 疑问代词．

或者 — 或许，也许．

发音 — 发出的语言．

可是 — 连词，表示转折．

意思 — 语言文字的意义．

可以 — 必可能或能够．

字典 — 以字为单位，按一定次序排列，每个字注上读音，意义和用发的工具书．

词典 — 收集词汇加以解释供人检查参考的工具书．

3.1.4 Text 4

汉字形美，意味深长，历史文化，尽在其中，

学习汉字，前途曲折，现在开始，为时不晚，

掌握汉字，充实知识，每人的權，每人的利．

字典

形 - xing 2 ; 样子：三角形．

美 - mei 3 ; 好，善：美德．

味 - wei 4 ; 意味，情趣：趣味．

深 - shen 1 ; 从表面到底或从外面到里面距离大的，跟"浅"相反".

长 - chang 2 ; 长度，两端的距离：这块布三尺长．

历 - li 4 ; 经历，经过：历尽甘苦．

史 - shi3 ; 历史，自然或社会以往发展的进程．

化 - hua 4 ; 性质或形态改变．

尽 - jin 3 ; 极，最：尽底下．

其 - qi 2 ; 代词：他，他们．

中 - zhong 1 ; 和四方，上下或两端距离同等的地位：中央．

前 - qian 2 ; 跟“后“相反．

途 - tu 2 ; 道路：坦途．

曲 - qu 1 ; 弯，跟“直“相反．

折 - zhe 2 ; 弯转，屈曲：折腰．

现 - xian 4 ; 现在，目前：现况．

为 - wei 4 ; 表目的：为进一步巩固无产阶级专政而斗争．

掌 - zhang 3 ; 巴掌，手心，手的里面：易如反掌．

握 - wo 4 ; 攥，手指弯曲合拢来拿：握手．

充 - chong 1 ; 满，足：充其量．

实 - shi 2 ; 充满：虚实．

每 - mei 3 ; 指全体中的任何一个或一组：每人．

人 - ren 2 ; 能制造工具并能使用工具进行劳动的动物．

權 - quan 2 ; 權利：选举權利．

利 - li 4 ; 好处，跟“害“反象．

词典

意味 - 含蓄的意思，情调，情趣，趣味：富于文学意味．

深长 - 深刻而耐人寻味：意味深长．

历史 - 自然界和人类社会的发展过程．

文化 - 人类在社会历史发展过程中所创造的物质财富和精神财富的总和，特指精神财富，如文学，艺术，教育科学等．

曲折 - 弯折：沿着池塘有一条曲折的小路．

现在 - 这个时候，说话的时候．

掌握 - 了解事物．

充实 - 丰富，充足：文字流畅，内容充实．

知识 - 人们在改造世界的实践中所获得的認识和经验的总和．

3.1.5

字典

本 – ben 3　　草木的根，跟“末“相反：无本之木。

不 – bu 4　　否定词，表示否定的意义：他不来。

长 – chang 2　　长度，两端的距离：这块布三尺长。

常 – chang 2　　平常，普通的，一般的。

充 – chong 1　　满，足：充其量。

出 – chu 1　　跟“入“，“进“　相反。

词 – ci 2　　在句子里能自由运用的最小的语言单位。

从 – cong 2　　自，由：从南到北。

道 – dao 4　　道儿，路：火车道。

到 – dao 4　　达到，到达：到北京。

的 – de　　在词或语后表明形容词性：伟大的。

得 – de　　用在动词或形容词后连接表结果或程度的补语：跑得快。

点 – dian 3　　1少量，2汉字的一种笔形。

典 – dian 3　　可以作为标准，典范的书籍：典籍。

调 – diao 4　　语言中字音的声调。

都 – dou 1　　全，完全：工作不论大小，都要做好。

读 – du 2　　依照文字念：宣读。

发 – fa 1　　表达，说出：发言。

非 – fei 1　　跟“是“相反。

复 – fu 4　　回去，返：翻来复去。

个 – ge 4　　量词。

果 – guo 3　　果子，果实，某些植物花落后含有种子的部分：水果。

汉 – han 4　　朝代名，汉族：我国人数最多的民族。

和 – he 2　　连词，跟，同：我和他意见相同。

候 – hou 4　　时节：时候。

化 – hua 4　　性质或形态改变。

会 – hui 4　　能：表示懂得怎样做或有能力做：他会游泳。

或 – huo 4　　或者，也许，表示不定的词：或远或近。

尽 – jin 3　　极，最：尽底下。

就 – jiu 4　　凑近，靠近：就着灯光看书。表示肯定语氣的词。

开 – kai 1　　1起始，2把关闭的东西打开。

看 – kan 4　　瞧，瞅，：看书，看电影。

可 – ke 3　　可能：能够有实现的条件:这个计划可能提前实现.

课 – ke 4　　功课，有计划的分段教学：上课。

来 – lai 2　　由另一方面到这一方面，跟“去“，“往“相反。

了 – le　　放在动词或形容词后，表示动作或变化已经完成：买了一本书。

里 – li 3　　里面，内部，跟“外“相反：屋子里。

历 – li 4　　经历，经过：历尽甘苦。

利 – li 4　　好处，跟“害“相反。

丽 – li 4　　好看，漂亮：美丽。

么 – me　　词尾：怎么。

美 – mei 3　　好，善：美德。

每 – mei 3　　指全体中的任何一个或一组：每人。

某 – mou 3　　代替不明確指出的人，地，事，物等用的词:某人.

拿 – na 2　　用手取，握在手里：拿笔。

能 – neng 2　　能力，才干，本事：各尽其能。

念 – nian 4　　诵读：念书。

宁 – ning 2　　安宁。南京市的别称。

拼 – pin 1　　连合，凑合：东拼西凑。

七 – qi 1　　数目字。

其 – qi 2　　代词：他，他们。

前 – qian 2　　跟“后“相反。

曲 – qu 1　　弯，跟“直“相反。

權 – quan 2　　權利：选举權利。

人 – ren 2　　能制造工具并能使用工具进行劳动的动物。

認 – ren 4　　分辨，识别：認字。

如 – ru 2　　如果，假若，假使：如不同意，可提意见。

上 – shang 4　　位置在高处的，跟“下“相反。

深 – shen 1　　从表面到底或从外面到里面距离大的，跟“浅“相反。

生 – sheng 1　　出生，诞生：生辰。

声 – sheng 1　　声音，物体振动时所产生的能引起听觉的波：声如洪钟。

时 – shi 2　　时间，一切物质不断变化或发展所经历的过程。

识 – shi 2　　知道，認得，能辨别：识字。

实 – shi 2　　充满：虚实。

史 – shi 3　　历史，自然或社会以往发展的进程。

始 – shi 3　　开始，起头，最初：开始报告。

是 – shi 4　　表示解释和分类：他是工人。

书 – shu 1　　成本的著作。

思 – si 1　　想，考虑，动脑筋：做事要三思。

四 – si 4　　数目字。

他 – ta 1　　称你，我以外的第三人，一般指男性。

她 – ta 1　　称你，我以外的女性第三人。

它 – ta 1　　他，专指事物。

途 – tu 2　　道路：坦途。

晚 – wan 3　　太阳落了的时候：从早到晚。

忘 – wang 4　　忘记，不记得。

为 – wei 4　　表目的：为进一步巩固无产阶级专政而斗争。

味 – wei 4　　意味，情趣：趣味。

文 – wen 2　　文字，记录语言的符号：甲骨文，外文。

握 – wo 4　　攥，手指弯曲合拢来拿：握手。

习 – xi 2　　学过后再温熟，反复地学使熟练：自习，复习。

现 – xian 4　　现在，目前：现况。

写 – xie 3　　写字的　“写“。

形 – xing 2　　样子：三角形。

学 – xue 2　　学习，活到老，学到老。

也 – ye 3　　副词，表示同样，并行等意义：你去，我也去。

一 – yi 1　　数目字。

以 – yi 3　　用，拿，把，将：以少胜多。

椅 – yi 3　　椅子，有靠背的坐具。

意 – yi 4　　意思，心思：同意。

音 – yin 1　　声：口音。

用 – yong 4　　使用，使人，物发挥其功能：用电。

有 – you 3　　跟“无“相反，表所属：他有一本书。

遇 – yu 4　　相逢，会面，碰到：遇雨。

在 – zai 4　　存在于某地点：“书在桌子上呢“。

怎 – zen 3　　疑问词，如何：怎样？

掌 – zhang 3　　巴掌，手心，手的里面：易如反掌。

折 – zhe 2　　弯转，屈曲：折腰。

者 – zhe 3　　代词，多指人。

真 – zhen 1　　真实，跟客观事物相符合，跟“假“相反。

知 – zhi 1　　知道，晓得，明了：知无不信。

中 – zhong 1　　和四方，上下或两端距离同等的地位：中央。

钟 – zhong 1　　指钟点，时间：二点钟。

桌 – zhuo 1　　桌子：一种日用的家具，上面可以放东西。

子 – zi 3　　古代指儿女，现在专指儿子。

字 – zi 4　　文字，用来记录语言的符号：汉字。

坐 – zuo 4　　坐立的“坐“：坐在凳子上。

3.1.6

词典

充实 – chong 1 shi 2 丰富，充足：文字流畅，内容充实。

词典 – ci 2 dian3 收集词汇加以解释供人检查参考的工具书。

发音 – fa 1 yin 1 发出的语言。

非常 – fei 1 chang 2 十分，极，非常光荣。

复习 – fu 4 xi 2 把学过的东西再学习，使巩固。

汉字 – han 4 zi 4 记录汉语的文字。

或者 – huo 4 zhe 3 或许，也许。

开始 – kai 1 shi 3 从头起，从某一点起:新的一年开始了.

可能 – ke 3 neng 2 表示可以实现：可能性。

可是 – ke 3 shi 4 连词，表示转折。

可以 – ke 3 yi 3 表示可能或能够。

课文 – ke 4 wen 2 教科书中的正文。

历史 – li 4 shi 3 自然界和人类社会的发展过程。

丽丽 – li 4 li 4 名字。

宁宁 – ning 2 ning 2 名字。

拼音 – pin 1 yin 1 把两个或两以上的音素结合起来成为一个复合的音。拼音文字：用符号来表示语言的的文字。

曲折 – qu 1 zhe 2 弯折：沿着池塘有一条曲折的小路。

認识 – ren 4 shi 2 能够確定某一人或事物是这个人或事物而不是别的：我認识他。

認真 – ren 4 zhen 1 严肃对待，不马虎：認真学习。

如果 – ru 2 guo 3 连词，表示假设：你如果有困难,我可以帮助你.

深长 - shen 1 chang2 深刻而耐人寻味：意味深长。

生词 - sheng 1 ci 2 不認识的词。

声调 - sheng1 diao 4 音调，字调。

时候 - shi 2 hou 4 时间：现在是什么时候了。

晚上 - wan 3 shang 4 太阳落了以后到深夜以前的时间，也泛指夜里。

文化 - wen 2 hua 4 人类在社会历史发展过程中所创造的物质财富和精神财富的总和，特指精神财富，如文学,艺术,教育科学等。

现在 - xian 4 zai 4 这个时候，说话的时候。

学习 - xue 2 xi 2 从阅读，听讲，研究，实践中获得知识或技能：学习文化。

椅子 - yi 3 zi 有看靠背的坐具。

意思 - yi 4 si 1 语言文字的意义。

意味 - yi 4 wei 4 含蓄的意思，情调，情趣，趣味:富于文学意味.

怎么 - zen 3 me 疑问代词。

掌握 - zhang 3 wo 4 了解事物。

知道 - zhi 1 dao 4 对于事实或道理有認识：你的意思我知道。

知识 - zhi 1 shi 2 人们在改造世界的实践中所获得的認识和经验的总和

桌子 - zhuo 1 zi 家具，上有平面，下有支柱，在上面放东西或做事情:一张桌子。

字典 - zi 4 dian 3 以字为单位，按一定次序排列,每个字注上读音,意义和用法的工具书。

3.2.1

```
k?: dii
778 966 985 81 738 472 1 93.
93 55 738 95 35 52 248.
67 67 47 93.
52 248 55 738 37 991.
67 67 401 290 37 991.

zd3
778    z9;    c: z9 0 m{ di d3< 5u z9 |o z 5( n?
966    |oa    |o z< i |/ j 4 d g6 g0! 5( m3 k? i f( d/ hi
985    z.     gu d9 | r n0! h3 z9 |7 | r z
81     5(;    w | z9 g+ qu d?, g) >h6> hx fv
738    8.     g) >u> hx fv! b` so 5u< t* 8 i b) 5u
472    ia     5u mu z
1      b).    c+ mu d? g)! g) m? hx fv< u b) | mu
93     5ua    q# b) d? |u zo
55     li.    li m3! n~ bu! g) y hx fv< u z li
95     s;     5u mu z
35     g?;    lx c
52     k?;    g/ k?! 8 gi h% d? f) d7 g` h}< 5( k?
248    :,     : z! gi lu 0 3 d? fu h+< g6 gu :! y :
67     n1,    v n1! nv g1 5 d? be q#
47     kv;    k`! q{< kv 5u! kv d3 1
37     hv;    q+ d9 m1! hv zu< o go j) 5u zw do d? m2 zu
991    z;     : z! 4 19 gi lu 0 3 d? fu h+< hv z
401    h},    h} hi! ho d+ 1+! h} d+ 1+
290    hi,    h} go h{ z9 : 5u! fv fu d? h} 5 5u 13< z hi! fu hi

cd3
966 985      |oa z          g6 g0! 5( 8 p1 m3! h6 8 | |u! z9 5( m3 f( d/ hi
                            ho zo 5 k1< i |( |o z
52 248       k?; :,         g` k? 5u |/ d? |# :
67 67        n1, n1,        m1 z
37 991       hv; z;         gi lu hv 0 d? : z
401 290      h}, hi,        c/ } du! t1 gx! 3 gt! 5 g3 |/ ho d~ | 5 ho gi
                            n#< h} hi : h%
```

3.2.2

```
k?: dir
111 81 70 21 921, 67 67 46 90 33 290.
97 33 290 83 7, 66 52 248, 345 37 991.
58 58 453 33 290.
98 8 966 985 55 64 6 53 472 1 93, 99 778 555 985 81 47.
98 47 19 31 4 76 871.

zd3
111    7.     t9 x lo l? d? 5 h{< c/ z+ d+ 7
70     kia    5u mu z
21     d3.    5+ lx! hv z d? i q/ bi h1
921    ¦/a    ¦ ¦/ d3! 5 g3< r d3 ¦/
46     k9a    ki 5! b* g7 bi d? d/ hi d* k9
90     5.     k9 5! ki t{! zw qu< k9 5 b+ g+
33     fu;    hw k0! fv< fv 19 fu k0
97     t*a    q# ni! o i y d? di sv j)! i bv ¦ nv h1
83     5#a    qu 5#! dv 5#< 5# q)
7      c,     z9 g0 z li n# z 8 4 d? zw h` d? 0 3 dv wz
66     n3;    s/ du< n3 5u
345    he.    he z d? >he>
58     li;    h+ kv! p` lx< m~ li
453    e.     fu c! b` 5 t/ x! b1 h1 d# i i< ni k0! o e k0
98     t*a    q# ni! o i y d? n0 h1 di sv j)
8      c/,    z! 8< c/ nv d+ b~
64     n*,    4 5{ k0! o z9 5{ li< n* bi
6      qua    g) >ju>! >g2> hx fv
53     19,    8 11 i f( m3 d+ ¦? i f( m3! g) >k0>! >=> hx fv
999    zo;    zo w d? >zo>< zo z9 d# z 5(
555    i.     i z! - 8 k+ b~ d? zo g0
19     d?     4 z9 d/ c ho h1 j/ c h{ l3 ge b` ge go ho q# du d? bu 0<
              p+ d? ky
31     f~a    g) >5> hx fv
4      q(,    p1 q(! pu t/ d?! i bv d?
76     j);    f) b3! 5 be< 5 z
871    ¦)a    ¦) 5! g) k? g7 5 u hx fu h?! g) >g6> hx fv

c d3
111 81      7. 5(;      t9 x l+ l? i h{ d+ 5) e i k3 d? 5 g3! e fv ¦ e li
46 90       k9a 5.      c/ t{ ki! c/ m{ i d3 ki< h2 d? i n3 k9 5 l?
33 290      fu; hi,     b* h} go d? d/ hi z9 h} hi! 5 g/ gu
83 7        5#a c,      bu j) 5 d? c
58 58       li; li;     m1 z
555 985     i. z        8 k+ b~ d? zo g0
31 4        f~a q(,     5 f)! gi! f~ q( g= j/
76 871      j); ¦)a     3 su dw d9! bu m* hu< j) ¦) h} hi
```

3.2.3

```
k?: disv
47 93 15 85 39, 93 81 15 991 2 48 65 35 35 26 76 86. 77 36 880 9 63 35
991 15 68 620 38 84 24, 135 54 792 59 345, 43 862 880 9 30 620, 48 91 2
880 9 99 15 619 94, 45 48 534 674 991 22. 77 36 741 10 83 7, 2 42 27,
453 2 880 9 619 94, 453 48 534 674 7 22.

zd3
85      5,      5 g3! i ke u ¦ bu d7 b3 h% ho f* ¦v so g1 li d? go q#
39      h{;     5 ge< 5 h{
15      d?      z9 c ho 0 h{ b` m1 h1 j/ c h1< w d* d?
2       bu;     f{ d1 c! - b` 5 f{ d1 d? i i< t* bu 19
48      k?.     k? n#< n# g{ 8 5 h3 d? t` g3< ¦? g? gi h% k? n# ti k3 5 h3
65      n#,     n# li! c9 gv! b) 5< g? g2 ki n#
26      d{a     k&! 7 k&< g/ zo bu 1: d* h`! d{ ` zo h+
86      5,      ¦ d+! j) d?! n# b3 be< 5 z
77      ju,     ju go! g6 jo! g6 5< ju bu t/ i! k? ti i g3
36      go.     go z! go 5! m{ he ¦ u h% lo h{ hv 8 ¦/ z d? bu f)< 5w go
880     ¦a      ¦ d+! h` d?! m1 1?< ¦ u bu h2
9       d+;     d+ r! lu< ho q? d+
63      m{.     d9 ti bu m1 k} ¦ qu d? j)! di! 5! u d# 4 d? c< m{ j)
68      p2a     13 h?! c{ h?< d/ p2 hi c{
620     2a      5#< k{ 2
38      h?,     13 c! g)! t/< o h? t* i g3 hx t/
84      5#a     5# 2! u ti ¦) d/ 5 so qv 5# d? n# 2 ki t1 g: d? b?< 5# ju
                h/ ¦/
24      d`;     0 3 ¦/ z 2 d? 5# d`
135     =;      = gi! bu gi d?
54      1?      f( z9 d/ c ho h1 j/ c h{! b` 5 d/ zo ho b3 h% i g1 7 q#<
                m9 1? i b) 5u
792     z).     i : c! ju h?< z) x
59      m?      c w< z) m?
43      ho;     ho ¦?! e h0! b` 5 bu d1 d? c< ho & ho g2
862     ¦?.     d9 c! do ¦ j)
30      f*a     b` d*! 5o qu< f* 3
91      5;      b` 5 ge 5 h? f) 1~< t* 5 g/ j)
99      t*a     t* ¦7 ¦ 5 u
619     i;      i s! h2 s< t/ i
94      sa      hx! k+ 10! d/ n+ g2< zo 5 ` sv s
45      gt;     c{ g2! k+ g2< gt ¦? d# g= kv 5u< b` 5 k) d1 0 ki d? c
534     i.      4! n*! b*! gx< i 5+ 5# do
674     4;      5 4< 5 j)< u f* hw ki g/ n#< 4 d3
22      d3.     k? i zo w b` ¦:! d3 fv d? 5u gi< d3 gi
741     0;      hx f#! hw m3! p# d+< 0 0
10      d+;     d* d+! d+ d*< d+ b~ g1
42      hw;     n#< b` 5 d/ d? z) x zo ho 8 n# li zo< t* hw 8 4
27      du,     i ¦+ : z n3< h& du
```

c d3

85 39	5, h{;	5 g3< h3 z9 5 5m m? 5 h{ l?
48 65	k?. n#,	b` 5 k? i 5 h3< k? n# h1
76 86	j); 5,	n# g{ k} d1 m{ i j) ho 5 u 5 ¦~ g? j) ho 5 u r bu 5 be d?< o j) 5 t*
77 36	ju, go.	l3 c! b` 5 g6 5?< ni ju go 8 k: nv! o k? i b(¦u ni
880 9	¦a d+;	dw 0 5 5 ho d+ li 8 j) 5< ni d? i s o ¦ d+
68 620	p2a 2a	b* lx g? ho lx i 5(d? 2 su ge h? ki l9 q# w i g? fu h? d? 2 p2 2 : z< 4 fu h+ l9 b` 5 0 3 d? : z
84 24	5#a d`;	2 d`! z d`
792 59	z). m?	i : d9 c
43 862	ho; ¦?.	ho h0! e h0
30 620	f*a 2a	f* qu d? 0 3
48 91	k?. 5;	l3 c! b` 5 ¦7 ¦?
619 94	i; sa	0 3 : z d? i i
48 534	k?. i.	b` 5 k? n# ho n# g{
991 22	z; d3.	i z w dv w! v i d1 c h0 p9 le! m~ g? z ¦u 5(du 2! i i h? 4 f* d? g/ g0 5u
7 22	c, d3.	5{ gi c hw g6 i ge 5 g/ j) g3 q* cv k+ d? g/ g0 5u

3.2.4

```
k?:dis
37 991 387 61, 619 184 82 3, 56 89 248 41, 44 778 71 912,
401 290 37 991, 72 100 73 857, 319 778 46 90, 169 85 2 111,
838 279 37 991, 5 88 880 86, 62 75 15 74, 62 75 15 57.

zd3
387    h1,    x z< sv g` h1
61     m~.    h+! 5v< m~ d?
184    w;     i w! k1 k0< k0 w
82     5)a    c/ b` m3 d+ di ho c/ y m3 d+ li m3 g0 li d* d?! g) >k3> hx
              fv
3      q(,    q( du! lx d7 d? g0 li< ¦? ky bu sv q q(
56     li;    g1 li! g1 go< li g2 gv ku
89     5.     li 5! z jv ho 5? hw i = f* ¦v d? g2 q#
41     h%;    h1 ¦ ho h1 t9 g9 b3
44     g2.    gi! zw< g2 di h6
71     ki,    d9 c< t*! t* m)
912    ¦/a    h? s f(! 5( h6 ho lx d7 g0 li t/ d# d? di w< ¦/ x
72     k3,    g) >h{> hx fv
100    tu,    d+ lu< tv tu
73     k0a    7! g) >¦> hx fv
857    ¦?,    7 ¦7! k0 k0< ¦? `
319    h3;    h3 z9! mu k3< h3 k=
169    w;     b` mu< d? w g2 i bu g/ gu u qv ge gi ¦7 ¦# r d{ ¦#
838    ¦(.    b* ¦(! 5{ h2! 5{ d? li m3< i ju fv ¦(
279    o;     z7! 5{ ¦ 7 k0 h? 1/ 19 n*< o 5{
5      q/a    mv! zu< q/ ki lx
88     5,     q/ mv< h0 5
62     m~.    ¦ k& ti ¦/ d? j) h? i g? ho i zu< m~ j)
75     j),    n# ¦ z+ g/ g0 b1 n# 5 4 g/ g0 g2 h1 1+ d/ d? d/ u
74     k&,    k& li< h& g0 k& li
57     li;    h+ qu! g) >h9> fv hx

cd3
619 184      i; w;        hv h0 d? i s! k1 d`! k1 k0! k0 w< fu 0 : h} i w
82 3         5)a q(,      5) k? r n9 j)  w< i w 5) q(
56 89        li; 5.       z jv ge h? j) 1~ 5? hw d? f* ¦v go q#
248 41       :, h%;       j) 1~ z9 5? hw li 5l f* ¦v go q# ¦/ so q= z+ d?
                          u ¦ c9 fu h? g1 5) c9 fu d? z/ h?! t? ¦ g1 5)
                          c9 fu! ju : h}! i 5u! g` 0 k? h} d#
73 857       k0a ¦?,      7 ¦?< 3 ¦? q t( 8 i t` k0 ¦? d? h` lu
319 778      h3; z9;      ¦~ g? 5 h{! 5o h% d? 5 h{
838 279      ¦(. o;       1` ge 5 u
5 88         q/a 5,       f# fu! q/ zu< : z 1t q(! n~ j/ q/ 5z
880 186      ¦a 5,        j) m) z9 g9 z+ 5 ge d? 5 g3 ¦/ so ho d~ d? j)
                          5 h? g1 3k d? z/ h?
```

3.2.5

```
zd3
1       b).     c+ mu d? g)! g) >m?> hx fv< u b) ¦ mu
2       bu;     f{ d1 c! - b` 5 f{ d1 d? i i< t* bu 19
3       q(,     q( du! lx d7 d? g0 li< ¦? ky bu sv q q(
4       q(,     p1 q(! pu t/ d?! i bv d?
5       q/a     mv! zu< q/ ki lx
6       qua     g) >ju>! >g2> hx fv
7       c,      z9 g0 z li n# z 8 4 d? zw h` d? 0 3 dv wz
8       c/,     z! 8< c/ nv d+ b~
9       d+;     d+ r! lu< ho q? d+
10      d+;     d* d+! d+ d*< d+ b~ g1
15      d?      z9 c ho 0 h{ b` m1 h1 j/ c h1< w d* d?
19      d?      4 z9 d/ c ho h1 j/ c h{ 13 ge b` ge go ho q# du d? bu 0<
                p+ d? ky
21      d3.     5+ lx! hv z d? i q/ bi h1
22      d3.     k? i zo w b` ¦:! d3 fv d? 5u gi< d3 gi
24      d`;     0 3 ¦/ z 2 d? 5# d`
26      d{a     k&! 7 k&< g/ zo bu 1: d* h`! d{ ` zo h+
27      du,     i ¦+ : z n3< h& du
30      f*a     b` d*! 5o qu< f* 3
31      f~a     g) >5> hx fv
33      fu;     hw k0! fv< fv 19 fu k0
35      g?;     lx c
36      go.     go z! go 5! m{ he ¦ u h% lo h{ hv 8 ¦/ z d? bu f)< 5w go
37      hv;     q+ d9 m1! hv zu< o go j) 5u zw do d? m2 zu
38      h?,     13 c! g)! t/< o h? t* i g3 hx t/
39      h{;     5 ge< 5 h{
41      h%;     h1 ¦ ho h1 t9 g9 b3
42      hw;     n#< b` 5 d/ d? z) x zo ho 8 n# li zo< t* hw 8 4
43      ho;     ho ¦?! e h0! b` 5 bu d1 d? c< ho & ho g2
44      g2.     gi! zw< g2 di h6
45      gt;     c{ g2! k+ g2< gt ¦? d# g= kv 5u< b` 5 k) d1 0 ki d? c
46      k9a     ki 5! b* g7 bi d? d/ hi d* k9
47      kv;     k`! q{< kv 5u! kv d3 1
48      k?.     k? n#< n# g{ 8 5 h3 d? t` g3< ¦? g? gi h% k? n# ti k3 5 h3
52      k?;     g/ k?! 8 gi h% d? f) d7 g` h}< 5( k?
53      l9,     8 l1 i f( m3 d+ ¦? i f( m3! g) >k0>! >=> hx fv
54      l?      f( z9 d/ c ho h1 j/ c h{! b` 5 d/ zo ho b3 h% i g1 7 q#<
                m9 l? i b) 5u
55      li.     li m3! n~ bu! g) y hx fv< u z li
56      li;     g1 li! g1 go< li g2 gv ku
57      li;     h+ qu! g) >h9> hx fv
58      li;     h+ kv! p` lx< m~ li
59      m?      c w< z) m?
61      m~.     h+! 5v< m~ d?
62      m~.     ¦ k& ti ¦/ d? j) h? i g? ho i zu< m~ j)
63      m{.     d9 ti bu m1 k} ¦ qu d? j)! di! 5! u d# 4 d? c< m{ j)
64      n*,     4 5{ k0! o z9 5{ li< n* bi
65      n#,     n# li! c9 gv! b) 5< g? g2 ki n#
```

```
66    n3;   s/ du< n3 5u
67    n1,   v n1! nv g1 5 d? be q#
68    p2a   l3 h?! c{ h?< d/ p2 hi c{
70    kia   5u mu z
71    ki,   d9 c< t*! t* m)
72    k3,   g) >h{> hx fv
73    k0a   7! g) >|> hx fv
74    k&,   k& li< h& g0 k& li
75    j),   n# ¦ z+ g/ g0 b1 n# 5 4 g/ g0 g2 h1 l+ d/ d? d/ u
76    j);   f) b3! 5 be< 5 z
77    ju,   ju go! g6 jo! g6 5< ju bu t/ i! k? ti i g3
81    5(;   w ¦ z9 g+ qu d?, g) >h6> hx fv
82    5)a   c/ b` m3 d+ di ho c/ y m3 d+ li m3 g0 li d* d?! g) >k3> hx
            fv
83    5#a   qu 5#! dv 5#< 5# q)
84    5#a   5# 2! u ti ¦) d/ 5 so qv 5# d? n# 2 ki t1 g: d? b?< 5# ju
            h/ ¦/
85    5,    5 g3! i ke u ¦ bu d7 b3 h% ho f* ¦v so g1 li d? go q#
86    5,    ¦ d+! j) d?! n# b3 be< 5 z
88    5,    q/ mv< h0 5
89    5.    li 5! z jv ho 5? hw i = f* ¦v d? g2 q#
90    5.    k9 5! ki t{! zw qu< k9 5 b+ g+
91    5;    b` 5 ge 5 h? f) l~< t* 5 g/ j)
93    5ua   q# b) d? ¦u zo
94    sa    hx! k+ l0! d/ n+ g2< zo 5 ` sv s
95    s;    5u mu z
97    t*a   q# ni! o i y d? di sv j)! i bv ¦ nv h1
98    t*a   q# ni! o i y d? n0 h1 di sv j)
99    t*a   t* ¦7 ¦ 5 u
100   tu,   d+ lu< tv tu
111   7.    t9 x lo l? d? 5 h{< c/ z+ d+ 7
135   =;    = gi! bu gi d?
169   w;    b` mu< d? w g2 i bu g/ gu u qv ge gi ¦7 ¦# r d{ ¦#
184   w;    i w! k1 k0< k0 w
248   :,    : z! gi lu 0 3 d? fu h+< g6 gu :! y :
279   o;    z7! 5{ ¦ 7 k0 h? l/ l9 n*< o 5{
290   hi,   h} go h{ z9 : 5u! fv fu d? h} 5 5u l3< z hi! fu hi
319   h3;   h3 z9! mu k3< h3 k=
345   he.   he z d? >he>
387   h1,   x z< sv g` h1
401   h},   h} hi! ho d+ l+! h} d+ l+
453   e.    fu c! b` 5 t/ x! b1 h1 d# i i< ni k0! o e k0
472   ia    5u mu z
534   i.    4! n*! b*! gx< i 5+ 5# do
555   i.    i z! - 8 k+ b~ d? zo g0
619   i;    i s! h2 s< t/ i
620   2a    5#< k{ 2
674   4;    5 4< 5 j)< u f* hw ki g/ n#< 4 d3
738   8.    g) >u> hx fv! b` so 5u< t* 8 i b) 5u
741   0;    hx f#! hw m3! p# d+< 0 0
778   z9;   c: z9 0 m{ di d3< 5u z9 ¦o z 5( n?
```

```
792    z).     i : c! ju h?< z) x
838    ¦(.     b* ¦(! 5{ h2! 5{ d? li m3< i ju fv ¦(
857    ¦?,     7 ¦7! k0 k0< ¦? `
862    ¦?.     d9 c! do ¦ j)
871    ¦)a     ¦) 5! g) k? g7 5 u hx fu h?! g) >g6> hx fv
880    ¦a      ¦ d+! h` d?! m1 1?< ¦ u bu h2
912    ¦/a     h? s f(! 5( h6 ho lx d7 g0 li t/ d# d? di w< ¦/ x
921    ¦/a     ¦ ¦/ d3! 5 g3< r d3 ¦/
966    ¦oa     ¦o z< i ¦/ j 4 d g6 g0! 5( m3 k? i f( d/ hi
985    z.      gu d9 ¦ r n0! h3 z9 ¦7 ¦ r z
991    z;      : z! 4 19 gi lu 0 3 d? fu h+< hv z
999    zo;     zo w d? >zo>< zo z9 d# z 5(
```

3.2.6

```
cd3
5 88        q/a 5,      f# fu! q/ zu< : z 1t q(! n~ j/ q/ 5z
7 22        c, d3.      5{ gi c hw g6 i ge 5 g/ j) g3 q* cv k+
                        d? g/ g0 5u
30 620      f*a 2a      f* qu d? 0 3
31 4        f~a q(,     5 f)! gi! f~ q( g= j/
33 290      fu; hi,     b* h} go d? d/ hi z9 h} hi! 5 g/ gu
37 991      hv; z;      gi 1u hv 0 d? : z
43 862      ho; ¦?.     ho h0! e h0
46 90       k9a 5.      c/ t{ ki! c/ m{ i d3 ki< h2 d? i n3 k9
                        5 1?
48 65       k?. n#,     b` 5 k? i 5 h3< k? n# h1
48 91       k?. 5;      13 c! b` 5 ¦7 ¦?
48 534      k?. i.      b` 5 k? n# ho n# g{
52 248      k?; :,      g` k? 5u ¦/ d? ¦# :
56 89       1i; 5.      z jv ge h? j) 1~ 5? hw d? f* ¦v go q#
58 58       1i; 1i;     m1 z
67 67       n1, n1,     m1 z
68 620      p2a 2a      b* 1x g? ho 1x i 5( d? 2 su ge h? ki 19
                        q# w i g? fu h? d? 2 p2 2 : z< 4 fu h+
                        19 b` 5 0 3 d? : z
73 857      k0a ¦?,     7 ¦?< 3 ¦? q t( 8 i t` k0 ¦? d? h` 1u
76 86       j); 5,      n# g{ k} d1 m{ i j) ho 5 u 5 ¦~ g? j)
                        ho 5 u r bu 5 be d?< o j) 5 t*
6 871       j); ¦)a     3 su dw d9! bu m* hu< j) ¦) h} hi
77 36       ju, go.     13 c! b` 5 g6 5?< ni ju go 8 k: nv! o
                        k? i b( ¦u ni
82 3        5)a q(,     5) k? r n9 j)  w< i w 5) q(
83 7        5#a c,      bu j) 5 d? c
84 24       5#a d`;     2 d`! z d`
85 39       5, h{;      5 g3< h3 z9 5 5m m? 5 h{ 1?
111 81      7. 5(;      t9 x 1+ 1? i h{ d+ 5) e i k3 d? 5 g3! e
                        fv ¦ e 1i
248 41      :, h%;      j) 1~ z9 5? hw 1i 51 f* ¦v go q# ¦/ so
                        q= z+ d? u ¦ c9 fu h? g1 5) c9 fu d? z/
                        h?! t? ¦ g1 5) c9 fu! ju : h}! i 5u! g`
                        0 k? h} d#
319 778     h3; z9;     ¦~ g? 5 h{! 5o h% d? 5 h{
401 290     h}, hi,     c/ } du! t1 gx! 3 gt! 5 g3 ¦/ ho d~ ¦ 5
                        ho gi n#< h} hi : h%
555 985     i. z        8 k+ b~ d? zo g0
619 94      i; sa       0 3 : z d? i i
619 184     i; w;       hv h0 d? i s! k1 d`! k1 k0! k0 w< fu 0
                        : h} i w
792 59      z). m?      i : d9 c
838 279     ¦(. o;      1` ge 5 u
880 9       ¦a d+;      dw 0 5 5 ho d+ 1i 8 j) 5< ni d? i s o ¦
                        d+
```

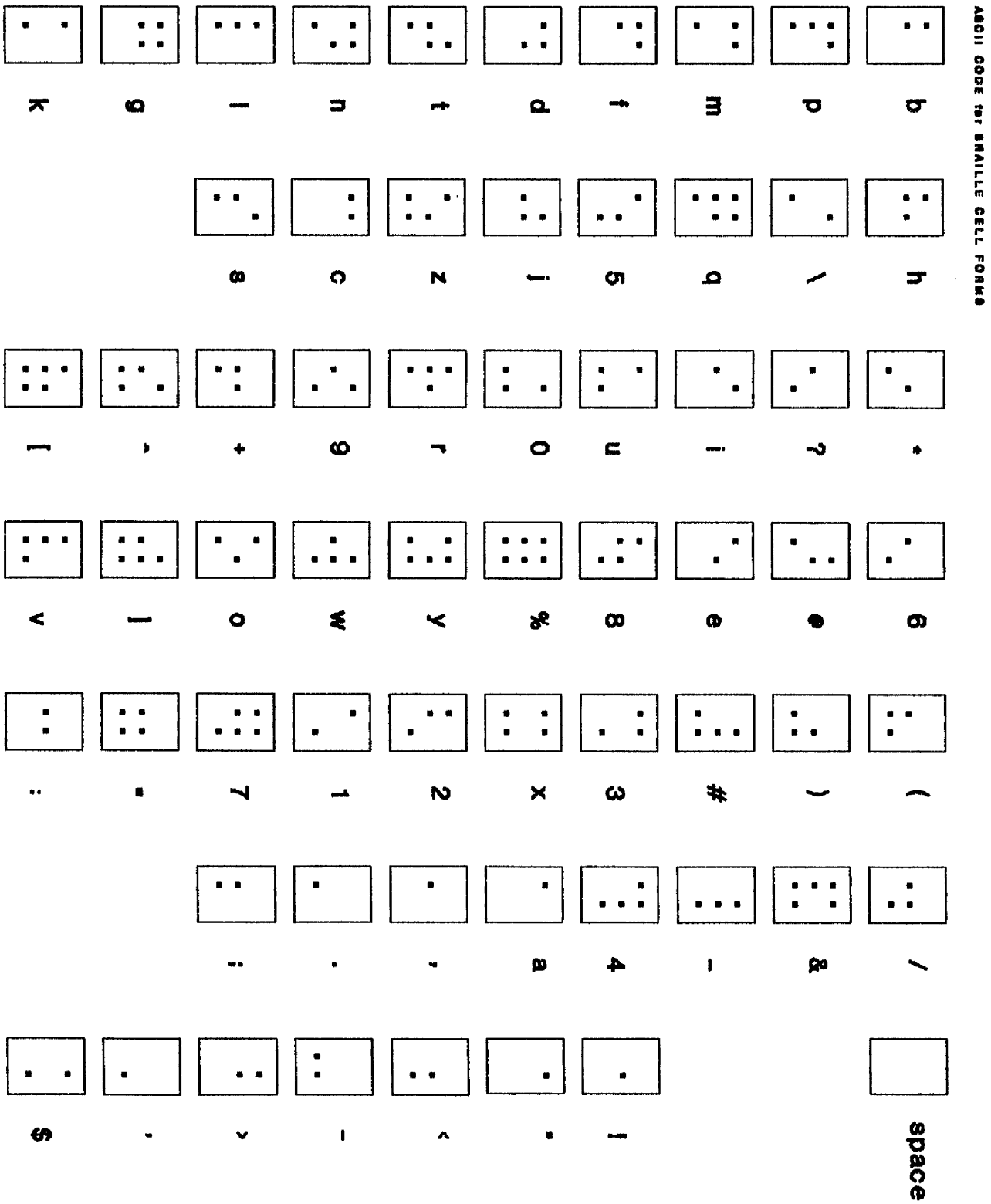
880	186	¦a 5,	j) m) z9 g9 z+ 5 ge d? 5 g3 ¦/ so ho d~ d? j) 5 h? g1 3k d? z/ h?
966	985	¦oa z	g6 g0! 5(8 p1 m3! h6 8 ¦ ¦u! z9 5(m3 f(d/ hi ho zo 5 k1< i ¦(¦o z
991	22	z; d3.	i z w dv w! v i d1 c h0 p9 1e! m~ g? z ¦u 5(du 2! i i h? 4 f* d? g/ g0 5u

3.3

*	a	d^	dei	h%	hua	k%	kua
v	an	d(	dang	h^	hei	k^	kei
(	ang	de	die	h(	hang	k(	kang
+	ao	du	du	hu	hu	ku	ku
9	ai	d+	dao	hy	huai	ky	kuai
b*	ba	d9	dai	h+	hao	k+	kao
b3	bian	dt	diu	h9	hai	k9	kai
bv	ban	d:	dun	h:	hun	k:	kun
b#	beng	?	e	5*	sha	l*	la
b)	ben	#	eng	5w	shui	l]	l]e
b1	bing	)	en	5v	shan	l3	lian
bi	bi	r	er	5?	she	lv	lan
b2	bin	^	ei	5#	sheng	l?	le
b@	biao	f*	fa	5)	shen	l#	leng
b?	bo	fv	fan	5	shi	l1	ling
b^	bei	f#	feng	5=	shuang	li	li
b(	bang	f)	fen	57	shuan	l2	lin
be	bie	f?	fo	5o	shuo	l/	long
bu	bu	f[	fou	5[	shou	l@	liao
b+	bao	f^	fei	5%	shua	lx	liang
b9	bai	f(	fang	5^	shei	l7	luan
c*	ca	fu	fu	5(	shang	lo	luo
cw	cui	g*	ga	5u	shu	l[	lou
cv	can	gw	gui	5y	shuai	l6	lia
c?	ce	gv	gan	5+	shao	l^	lei
c#	ceng	g?	ge	59	shai	l(	lang
c)	cen	g#	geng	5:	shun	le	lie
c	ci	g)	gen	g]	jue	lu	lu
c/	cong	g/	gong	g3	jian	l0	l]
c7	cuan	g=	guang	g1	jing	l+	lao
co	cuo	g7	guan	gi	ji	l9	lai
c[	cou	go	guo	g2	jin	lt	liu
c(	cang	g[	gou	g4	jiong	l:	lun
cu	cu	g%	gua	g@	jiao	m*	ma
c+	cao	g^	gei	gx	jiang	m3	mian
c9	cai	g(	gang	g&	juan	mv	man
c:	cun	gu	gu	g6	jia	m?	me
d*	da	gy	guai	ge	jie	m#	meng
dw	dui	g+	gao	g0	ju	m)	men
d3	dian	g9	gai	gt	jiu	m1	ming
dv	dan	g:	gun	g_	jun	mi	mi
d?	de	h*	ha	k*	ka	m2	min
d#	deng	hw	hui	kw	kui	m@	miao
d)	den	hv	han	kv	kan	m?	mo;me
d1	ding	h?	he	k?	ke	m[	mou
di	di	h#	heng	k#	keng	m^	mei
d/	dong	h)	hen	k)	ken	m(	mang
d@	diao	h/	hong	k/	kong	me	mie
d7	duan	h=	huang	k=	kuang	mu	mu
do	duo	h7	huan	k7	kuan	m+	mao
d[	dou	ho	huo	ko	kuo	m9	mai
d6	dia	h[	hou	k[	kou	mt	miu

n*	na	k&	quan	tu	tu	h3	xian
n]	n]e	k9	qia	t+	tao	h1	xing
n3	nian	ke	qie	t9	tai	hi	xi
nv	nan	k0	qu	t:	tun	h2	xin
n?	ne	kt	qiu	*	zha	h4	xiong
n#	neng	k_	qun	\w	zhui	h@	xiao
n)	nen	jw	rui	\v	zhan	hx	xiang
n1	ning	jv	ran	\?	zhe	h&	xuan
ni	ni	j?	re	\#	zheng	h6	xia
n2	nin	j#	reng	\)	zhen	he	xie
n/	nong	j)	ren	\	zhi	h0	xu
n@	niao	j	ri	\/	zhong	ht	xiu
nx	niang	j/	rong	\=	zhuang	h_	xun
n7	nuan	j7	ruan	\7	zhuan	6	ya
no	nuo	jo	ruo	\o	zhuo	]	yue
n[	nou	j[	rou	\[	zhou	3	yan
n^	nei	r%	rua	\%	zhua	e	ye
n(	nang	j(	rang	\^	zhei	1	ying
ne	nie	ju	ru	\(	zhang	i	yi
nu	nu	j+	rao	\u	zhu	2	yin
n0	n]	j:	run	\y	zhuai	4	yong
n+	nao	s*	sa	\+	zhao	&	yuan
n9	nai	sw	sui	\9	zhai	!!	yo
nt	niu	sv	san	\:	zhun	8	you
m	m	s?	se	q*	cha	x	yang
n	n	s#	seng	qw	chui	0	yu
?	o	s)	sen	qv	chan	@	yao
[	ou	s	si	q?	che	_	yun
p*	pa	s/	song	q#	cheng	z*	za
p3	pian	s7	suan	q)	chen	zw	zui
pv	pan	so	suo	q	chi	zv	zan
p#	peng	s[	sou	q/	chong	z?	ze
p)	pen	s(	sang	q=	chuang	z#	zeng
p1	ping	su	su	q7	chuan	z)	zen
pi	pi	s+	sao	qo	chuo	z	zi
p2	pin	s9	sai	q[	chou	z/	zong
p@	piao	s:	sun	q%	chua	z7	zuan
p?	po	t*	ta	q(	chang	zo	zuo
p[	pou	tw	tui	qu	chu	z[	zou
p^	pei	t3	tian	qy	chuai	z^	zei
p(	pang	tv	tan	q+	chao	z(	zang
pe	pie	t?	te	q9	chai	zu	zu
pu	pu	t#	teng	q:	chun	z+	zao
p+	pao	t1	ting	%	wa	z9	zai
p9	pai	ti	ti	7	wan	z:	zun
k]	que	t/	tong	/	weng		
k3	qian	t@	tiao	:	wen		
k1	qing	t7	tuan	o	wo		
ki	qi	to	tuo	w	wei		
k2	qin	t[	tou	=	wang		
k4	qiong	t^	tei?	u	wu		
k@	qiao	t(	tang	y	wai		
kx	qiang	te	tie	h]	xue		

3.3.1


ASCII CODE for BRAILLE CELL FORMS
space
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3.4

I. Verbal identification

The list is separated into four columns which represent the following:

Column 1: The character represented.

Column 2: The answer of respondent 1.

Column 3: The answer of respondent 2.

Column 4: Identical answers are marked with "#".
Almost identical answers are marked with "##".
Answers based on graphic compounds are marked with "c".

		Respondent 1		Respondent 2	identical
的	-	我的，你的，他的	/	目的	
一	-	一句话	/	一二三	
是	-	是不是	/	是不是	/ #
在	-	在不这里	/	是现在	
不	-	不是解	/	是不解	/ # #
了	-	了有钱	/	了有没有	/ #
有	-	有和平	/	有和平	/ #
和	-	和人民	/	和人民	/ #
人	-	人这个国	/	人这里国	/ #
这	-	这中小	/	这中国小	/ #
中	-	中大为人民	/	中大小人民服务	/ #
大	-	大为上下	/	大为上下	/ #
为	-	为上一个两个	/	为上一个二个	/ # #
上	-	上个国家	/	上个国家	/ #
个	-	个国我们	/	个国我你他	
国	-	国我以前	/	国我可以	
我	-	我以要好看	/	我以重要	
以	-	以要他的	/	以要他们	
要	-	要他时间	/	要他时间	/ #
他	-	他时来回	/	他时来去	
时	-	时来用过的	/	时来使用	
来	-	来用我们	/	来用我们	/ #
用	-	用我生活	/	用我生活	/ #
们	-	们生到来	/	们生到达	
生	-	生到作用	/	生到作用	/ #
到	-	到作地方	/	到作土地	
作	-	作地大于生	/	作地干钩于	/ / c
地	-	地大出来	/	地大出来	
于	-	于出就是别	/	于出就是	/ #
出	-	出就分	/	出就	
就	-	就分对话	/	就分对不对	
分	-	分对成绩	/	分对成绩	/ #
对	-	对成开会以	/	对成开会以	/ #
成	-	成开可主要	/	成开可主人	/ #
会	-	会可主发展的	/	会可主发展	/ #
可	-	可主发年龄	/	可主发龄	/ #
主	-	主发年运动会	/	主发年运动	/ # #
发	-	发年运同事	/	发年运同事	/ #
年	-	年运同工人	/	年运同工人	/ #
动	-	动同工也是	/	动同工也是	/ #
同	-	同工也能够	/	同工也不能	
工	-	工也能上下	/	工也能上下	/ #
也	-	也能上过去的事	/	也能上过去子	/ # #
能	-	能上过儿子话	/	能上过儿说话	/ #
下	-	下过儿说共产党	/	下过儿说生产	/ #

种面而方后多定行学法所民得经十三之进着等部度家电力里如水化高自二理起小物现实加量都两体制机当使点从业本

子面是面后少定动习律以民到经五三间进急待队度庭力量里果水化红由十想来心品在在加量是个育度机然用点现业来

种要而方前多决行学法所人得已一三之前着等部程家电力公如开开把自二理起小物现实参力都两体制飞当使一从工本

子子是方后少定动习律以民到济九二乎进急待队渡庭视量面果平化低由二由来小理在实减量都两体度构代使点个业来

种面而地前多决行学法所人得经八一之前着等部过家电力里如水文高自一理起大物现实加重首斤身制机当天标两工本

武 装

十 地 告 诉 你

一 两

十 三 则 （者） 也

三

眼 界

高 高 举 起

二

人

在 在

起

产 就 是 这 样

去手格坏该 ／ #
来把性好应 ／ #
去把性好应开它合还因由其些然前外政四日那社义事平形相全表间样与关各重新线内数正心反你明看原又么利比或但

开宝合 头的它 ／ ／c
因自其一自前外政一日那社主事平形相全表时样参关各重新针内数正心反你明看原再什利比或但

三四五
（太阳）

年把别好该始的作是为于他些然后国府海本个会义业平容信部演间品其心尽量中线部学好心对好白电来一么利较者是
去一性很应开它台还因由其一当前外政四日那社主事和形相全表中样与关各重新路内数正一反你明看原又那胜比或但

草 能
所国
一意
吗影个

质氣第向道命此变条只没结解问意建月公无系军很情者最立代想已通并提直题党程展五果料象员革位入常文总次品式

量力一上理命此化件只有果放题见设票司所系队好况者近场表法时讯且高接目产度开金果料征员命置门情化是品种式

质氣第向道革如变条一没结解问意建月公无关军很情或最立代想已通并提直题共程展五结材象党革位入常文总次品法

下场 鸡 军 用心 reading mistake 党

质氣第向道命此变条一没团解问意建月公一关军很感或最建代理已通并提直题共禾开四成材大团革座加经文总次产方

量候一上理令地化件只收结放候见设亮平一系队好情者好立表想经知且高接目产旁展五果料象员命位入常化统品品式

质氣第向道命此变条一没团解问意建月公二关军很感或最建代理已通并提直题共程展六果料象员命位入常化统品品式

量候一上理令地化件只收结放候见设亮平一系队好情者好立表想经知且高接目产党程

第二 无银三百两 二只

C

活设及管特件长求老头基资边流路级少图山统接知较长将组见计别她手角期根论运农指几九區強放决西被干做必战先

生建及管特条长求老头基资边流路级多图山统接知比长将组见计性她手角期树论运农指几九區強解决东被干做必战先

活建及管特条 要老头基 一河道级多地高统接知比科将组看计级女手头日树理运农手几八海強解决东被干做必战先

动设格理别件 求少脑础 条流路别少图山一受道较长军织见划别字脚上期根论动村指乎九淀大放定西子部东须争后

设格理别件征助师目础本境水线别少画坡治受道较春军织面划别的心落间根文动村导乎死别大放定西子部事须争生

活设格理别件征助师目础本境水线别少画坡治受道较春军织面划别的心落间根文动村导乎死别大放定西子部事须争生

主义

，女的

一生

十區

西

/ c

/ #

回则任取据处队南给色光门即保治北造百规熱领七海地口东导器压志世金增争济阶油思术极交受联什認六共權收证改

来原任取根处部南给景阳门即保治北造百规熱领七大地一东导武压同世金增斗济阶油思学极交受联什認六共權收证改

回则务得据理队京我色光房时卫理京就年定烈袖个海方口方濱器力志界錢加争南段矿想术端通理系么识十产力回明革

井红

田

六党

回则务得据理队北予色光门即卫理京造百定袖六海球口西导器力志界金加取济油思学极交接联什認六共權丰证改券革

different

二百

七

八党

清己美再采转更单风切打白教速花带安场身车例真务具万每目至达走积示议声报斗完类八离华名確才科张信马节话米

明己国见采单风一打黑教速花带安场身案真任工千每目至到走积表建声报争完人八离中名確刚科弓写一节说米

清自美再风位景切架白授度朵子全地体例假务具万一的于达路累示议音纸斗全类九开华字定才长长信匹日话饭

月

明己丽见取业好位吹要到白师度瓶子全合体辆如理必体万个的于到路累意论音纸争全别面开华名定才学长念上日语饭

风己丽见取业好位吹要到白师度瓶子全合体辆如理必体万个的于到路累意论音纸争全别面开华名定才学长念上日语饭

清自美再采转更单风切打黑教速花带安场身车例真务具千每目至达走积示议声报斗完类四离中姓確刚科弓信马节话米

草动

电视

八方

他说了

场

张

马

清己美再采转更单风切打白教速花带安场身车例真务具万每目至达走积示议声报斗完类八离华名確才科张信马节话米

/ # / C

整氣旦况令合度单地可步众播头者要段究界一林律喊且竟看南织装影术低　　声群书织复容儿胡国商非试连果深艰远矿
调空元情命集温传土许脚群广石记需阶研世拉森法叫而究观越纺武电算高　　音众本布活易子须际店洲验续断浅难近产

reading mistake

整空元况今集温传土许步群广石记需段研界拉林律叫且究观越织装影算低持音众书布复容儿须际商非验连断深难近矿
天想旦况天合情达地可调众播头记要段究界他林律喊且竟看过织装子术低别乐众包告活易子须际品洲验续决处难代工
整空元情今集温传土许步群广石日需阶研世拉森一叫而究观越纺武影算高特音群书布复容儿必国商非化连断深困近矿

| | | |

子 王 机

院查江型眼王按格养易置派层片始却专状育厂京识适属圆包火住调满县局照参红细引听该铁价严首底液官德调随病苏

院查河号睛子摩外育易置别层断始步门状育厂京识当于规装车宿查足城面相加旗心导语该锁格格都层体官行和边人联

的检江型眼王按格养容位派云片开却专奖养工南認适属圆包火住调满县局照参红细引听应铁价严首底液五德调随病苏

院检江型眼三按表 容位派层卡开却专奖体工北認适属团包火住调满县局照参红相引听应钢价严首底液 道 德 随 生 苏

子查河号睛横摩格 易置别次片始是门状育厂京识应于圆装车家查族城长片考色细导力该铁格格都层体 德 便 病 联

院查河号睛子摩外育易置别层断始步门状育厂京识当于规装车宿查足城面相加旗心导语该锁格格都层体官行和边人联

院查江型眼王按格养易置派层片始却专状育厂京识适属圆包火住调满县局照参红细引听该铁价严首底液官德调随病苏

c

失尔死讲配女黄推显谈罪神艺呢席含企望密批营项防举球英氧势告李台落木帮轮破亚师围注远字材排供河态封另施减
败只者话合儿山出然笑名情术呢席含业望切評业目止行球雄氣力诉子湾后木助子坏洲师团意远字料除应流度建外行减
失也死讲配女黄推显谈罪神艺你主包企希密批营项防举足英氧势告李台落树帮轮破亚导团注永写材排供河态封另旅加
去的亡话合儿色开示话罪话术龙席含业望密評长目止手球语氣势告子湾下头派轮坏洲傅圍意近字料练应流度建外也减
失尼死讲配女黄推显谈犯神艺呢主包企希秘批营项防举足英氧形报木台落木帮车破亚师包注远写材排供河态封另方加
尔 以 而 尔 尔 过 不 只 者 话 合 儿 山 出 然 笑 名 情 术 呢 席 含 业 望 切 評 业 目 止 行 球 雄 氣 力 诉 子 湾 后 木 助 子 坏 洲 师 团 意 远 字 料 除 应 流 度 建 外 行 减
住 围
李 旅

树	.....	木		/	树		/	#
溶	.....	解		/	种		/	#
怎	.....	样		/	溶		/	#
止	.....	止		/	怎		/	#
案	.....	件		/	阳		/	#
言	.....	言		/	案		/	#
士	.....	兵		/	方		/	#
均	.....	均		/	士		/	#
武	.....	器		/	均		/	#
固	.....	固		/	武		/	#
钩	.....	子		/	坚		/	#
痕	.....	痕		/	钩		/	#
坝	.....	坝		/	伤		/	#
香	.....	水		/	水		/	#
饿	.....	饿		/	香		/	#
祸	.....	祸		/	饥		/	#
丘	.....	基		/	祸		/	#
玄	.....	武		/	山		/	#
溜	.....	走		/	玄		/	#
曰	.....	本		/	溜		/	#
逻	.....	辑		/	扁	曰	/	#
彭	.....	彭		/	逻		/	#
尝	.....	试		/	彭	怀		
卿	.....	卿		/	尝		/	#
妨	.....	碍		/	国	卿		
艇	.....	艇		/	妨		/	#
吞	.....	吞		/	舰		/	#
韦	.....	韦		/	艇		/	#
怨	.....	恨		/	下	去		
矮	.....	子		/	国	清		
歇	.....	后	语	/	怨		/	#
郊	.....	區		/	子		/	#
禄	.....	姓		/	矮		/	#
捻	.....	线		/	歇	侯	（后）	语
漠	.....	然		/	郊	區		
粹	.....	粹		/				
颠	.....	倒		/	捻	线		
宏	.....	伟		/	冷	漠		
冤	.....	家		/	粉	粹		
脂	.....	肪		/	颠	倒		
饥	.....	饿		/	宏	伟		
一	.....	氣	呵 成	/	冤	枉		
仙	.....	人	掌	/	脂	肪		
押	.....	金		/	饥	饿		
埃	.....	及		/	口	旁加可以的可字		
甲	.....	醛		/	仙	女		
小	.....	布	娃，娃娃	/	押	金		
拾	.....	东	西	/	埃	及		
				/	糠	醛		
				/	娃	娃		
				/	收	拾		

II. List of Chinese Character Braille codes.

The list is separated into eight columns which represent the following:

Column I: Frequency according to xiandai hanyu zipin tongjibiao (Guojia Yuayan Wenzi Gongzuoweiyuanhui, 1992)

Column II: Pronunciation of the character represented according to hanyu pinyin.

Column III: Chinese character code according to ASCII. For translation into Braille cell forms see list 3.3.1. For translation into sounds see list 3.3.

Column IV: The character represented.

Column V: Characters with identical sound, part of identical sound, or lexical compounds.

Column VI: Graphic components.

Column VII: References to other characters.

Column VIII: Description of method according to which character code was designed:

- id - identical sound
- ids - part of identical sound
- exp - exception
- xm - graphic component or meaningful component
- xb - lexical compound
- xe - other
- nyc - not yet coded

I	II	III	IV	V	VI	VII	VIII
1.)	de	d	的	的			ids
2.)	yi	i	一	一			id
3.)	shi	5	是	是			id
4.)	zai	9	在	在			ids
5.)	bu	b	不	不			ids
6.)	le	l	了	了			ids
7.)	you	8	有	有			id
8.)	he	h	和	和			ids
9.)	ren	j	人	人			ids
10.)	zhe	\	这	这			ids/exp
11.)	zhong	/	中	中			ids
12.)	da	*	大	大			ids
13.)	wei	w	为	为			id
14.)	shang	(	上	上			ids
15.)	ge	g	个	个			ids
16.)	guo	og	国	我	国		xe/exp
17.)	wo	o	我	我			id
18.)	yi	ii	以	以			ids
19.)	yao	@	要	要			id
20.)	ta	t	他	他			ids
21.)	shi	5d	时	时			xb
22.)	lai	l9	来	来			id
23.)	yong	4	用	用			id
24.)	men	m	们	们			ids
25.)	sheng	#	生	生			ids
26.)	dao	+	到	到			ids
27.)	zuo	zo	作	作			id
28.)	di	di	地	地			id
29.)	yu	0	于	于			id
30.)	chu	q	出	出			ids
31.)	jiu	g8	就	就			id
32.)	fen	)	分	分			ids
33.)	dui	dw	对	对			id
34.)	cheng	q#	成	成			id
35.)	hui	hw	会	会			id
36.)	ke	?	可	可			ids
37.)	zhu	\u	主	主			id
38.)	fa	f	发	发			ids
39.)	nian	n	年	年			ids
40.)	dong	d/	动	动			id
41.)	tong	t/	同	同			id
42.)	gong	g/	工	工			id
43.)	ye	e	也	也			id
44.)	neng	n#	能	能			id
45.)	xia	h6	下	下			id
46.)	guo	go	过	过			id
47.)	zi	z	子	子			id
48.)	shuo	5o	说	说			id
49.)	chan	qv	产	产			id

50.)	zhong	\/	种	种			id
51.)	mian	m3	面	面			id
52.)	er	r	而	而			id
53.)	fang	f(	方	方			id
54.)	hou	[	后	后			ids
55.)	duo	do	多	多			id
56.)	ding	d1	定	定			id
57.)	xing	h1	行	行			id
58.)	xue	h]	学	学			id
59.)	fa	f*	法	法			id
60.)	suo	s	所	所			ids
61.)	min	m2	民	民			id
62.)	de	^	得	得			id/dei
63.)	jing	g1	经	经			id
64.)	shi	5i	十	十			ids
65.)	san	sv	三	三			id
66.)	zhi	\i	之	之			ids
67.)	jin	g2	进	进			id
68.)	zhe	\n	着	着	呢		xb
69.)	deng	d#	等	等			id
70.)	bu	bu	部	部			id
71.)	du	du	度	度			id
72.)	jia	g6	家	家			id
73.)	dian	d3	电	电			id
74.)	li	ll	力	力	量	力	xb/xm
75.)	li	li	里	里			id
76.)	ru	ju	如	如			id
77.)	shui	5w	水	水			id
78.)	hua	%	化	化			ids
79.)	gao	g+	高	高			id
80.)	zi	zi	自	自			ids
81.)	er	ri	二	二		一	xm
82.)	li	l=	理	理		王	xm
83.)	qi	k	起	起			id
84.)	xiao	h@	小	小			id
85.)	wu	u	物	物			id
86.)	xian	h3	现	现			id
87.)	shi	5m	实	实			xm
88.)	jia	a6	加	加			exp
89.)	liang	lx	量	量			id
90.)	dou	d[	都	都			id
91.)	liang	lj	两	两		人	xm
92.)	ti	ti	体	体			id
93.)	zhi	\\	制	制	止		xb
94.)	ji	gm	机	机		木	xm
95.)	dang	d(	当	当			id
96.)	shi	5j	使	使		人	xm
97.)	dian	dz	点	点	子		xb
98.)	cong	c/	从	从			id
99.)	ye	ee	业	业			ids
100.)	ben	b)	本	本			id

101.)	qu	k0	去	去			id
102.)	ba	b*	把	把			id
103.)	xing	ah	性	性			exp
104.)	hao	h+	好	好			id
105.)	ying	1	应	应			id
106.)	kai	k9	开	开			id
107.)	ta	t*	它	它			id
108.)	he	h?	合	合			id
109.)	hai	h9	还	还			id
110.)	yin	2	因	因			id
111.)	you	8c	由	由	此		xb
112.)	qi	kt	其	其	他		xb
113.)	xie	he	些	些			id
114.)	ran	jv	然	然			id
115.)	qian	k3	前	前			id
116.)	wai	y	外	外			id
117.)	tian	t3	天	天			id
118.)	zheng	\#	政	政			id
119.)	si	si	四	四			ids
120.)	ri	ji	日	日			id
121.)	na	n*	那	那			id
122.)	she	5?	社	社			id
123.)	yi	i\	义	义	肢	主义	xb
124.)	shi	5e	事	事	业		xb
125.)	ping	p	平	平			ids
126.)	xing	a1	形	形			exp
127.)	xiang	hx	相	相			id
128.)	quan	k&	全	全			id
129.)	biao	b@	表	表			id
130.)	jian	g3	间	间			id
131.)	yang	x	样	样			id
132.)	yu	0i	与	与		一	xm
133.)	guan	g7	关	关			id
134.)	ge	g?	各	各			id
135.)	zhong	/@	重	重	要		xb
136.)	xin	h2	新	新			id
137.)	xian	a3	线	线			exp
138.)	nei	n^	内	内			id
139.)	shu	5u	数	数			id
140.)	zheng	\#]	正	正	月		xb
141.)	xin	h29	心	心	爱		xb
142.)	fan	fv	反	反			id
143.)	ni	ni	你	你			id
144.)	ming	m1	明	明			id
145.)	kan	kv	看	看			id
146.)	yuan	&	原	原			id
147.)	you	88	又	又	又		ids/xe
148.)	me	m?	么	么			id
149.)	li	l4	利	利	用		xb
150.)	bi	bi	比	比			id
151.)	huo	ho	或	或			id

152.)	dan	dv	但	但			id
153.)	zhi	\b	质	质		贝	xm
154.)	qi	kh	氣	氣	息		xb
155.)	di	dr	第	第	二		xe
156.)	xiang	ax	向	向			exp
157.)	dao	d+	道	道			id
158.)	ming	mj	命	命		人	xm
159.)	ci	c	此	此			id
160.)	bian	b3	变	变			id
161.)	tiao	t@	条	条			id
162.)	zhi	\5	只	只	是		xb
163.)	mei	m^	没	没			id
164.)	jie	ge	结	结			id
165.)	jie	ae	解	解			exp
166.)	wen	:	问	问			id
167.)	yi	is	意	意	思		xb
168.)	jian	ag	建	建			exp
169.)	yue	]]	月	月			ids
170.)	gong	/s	公	公	司		xb
171.)	wu	um	无	无			xe
172.)	xi	hi	系	系			ids
173.)	jun	g_	军	军			id
174.)	hen	h)	很	很			id
175.)	qing	k1	情	情			id
176.)	zhe	\?	者	者			id
177.)	zui	zw	最	最			id
178.)	li	lz	立	立	姿		xb
179.)	dai	d9	代	代			id
180.)	xiang	hxf	想	想	法		xb
181.)	yi	i=	已	已	往		xb
182.)	tong	t4	通	通	用		xb
183.)	bing	b1	并	并			id
184.)	ti	t5	提	提	示		xb
185.)	zhi	\3	直	直	言		xb
186.)	ti	tm	题	题	目		xb
187.)	dang	d&	党	党	员		xb
188.)	cheng	q#d	程	程	度		xb
189.)	zhan	\v	展	展			id
190.)	wu	ui	五	五		一	im
191.)	guo	gom	果	果	木	木	xb/xm
192.)	liao	l@	料	料			id
193.)	xiang	hxk	象	象	棋		xb
194.)	yuan	&&	员	员			ids
195.)	ge	?m	革	革	命		xb
196.)	wei	wj	位	位		人	xm
197.)	ru	j^	入	入			xm
198.)	chang	q(	常	常			id
199.)	wen	::	文	文			ids
200.)	zong	/l	总	总	理		xb
201.)	ci	cd	次	次	第		xb
202.)	pin	p2	品	品			id

203.)	shi	5/	式	式	工			xm
204.)	huo	ao	活	活				exp
205.)	she	?b	设	设	备			xb
206.)	ji	g5	及	及	时			xb
207.)	guan	a7	管	管				exp
208.)	te	t?	特	特				id
209.)	jian	g3j	件	件	人			xm
210.)	chang	$—	长			see	No 227	
211.)	qiu	k8	求	求				id
212.)	lao	l+	老	老				id
213.)	tou	t[	头	头				id
214.)	ji	gb	基	基	本			xb
215.)	zi	zb	资	资	本	贝		xb/xm
216.)	bian	bg	边	边	际			xb
217.)	liu	l8	流	流				id
218.)	lu	lu	路	路				id
219.)	ji	gs	级	级	丝			xm
220.)	shao	5+	少	少				id
221.)	tu	tu	图	图				id
222.)	shan	5v	山	山				id
223.)	tong	ts	统	统	丝			xm
224.)	jie	ge[	接	接	受			xb
225.)	zhi	\d	知	知	道			xb
226.)	jiao	g@	较	较				id
227.)	zhang	\#	长	长				id
228.)	jiang	gx	将	将				id
229.)	zu	zu	组	组				id
230.)	jian	g3m	见	见	面			xb
231.)	ji	gh%	计	计	划			xb
232.)	bie	be	别	别				id
233.)	ta	tn	她	她	女			xm
234.)	shou	5[	手	手				id
235.)	jiao	a@	角	角				exp
236.)	qi	kd	期	期	待			xb
237.)	gen	g)	根	根				id
238.)	lun	l:	论	论				id
239.)	yun	_	运	运				id
240.)	nong	n/	农	农				id
241.)	zhi	\t	指	指	头			xb
242.)	ji	gi	几	几				ids
243.)	jiu	a8	九	九				exp
244.)	qu	ak	區	區				exp
245.)	qiang	qx	強	強				id
246.)	fang	fp	放	放	屁			xb
247.)	jue	g]	决	决				id
248.)	xi	hb	西	西	北			xe/xb
249.)	bei	b^	被	被				id
250.)	gan	gv	干	干				id
251.)	zuo	az	做	做				exp
252.)	bi	bd	必	必	得			xb
253.)	zhan	av	战	战				exp

254.)	xian	h3[	先	先	后				xe/xb
255.)	hui	hwl	回	回	来				xb
256.)	ze	z?	则	则					id
257.)	ren	jj	任	任		人			xm
258.)	qu	a0	取	取					exp
259.)	ju	g0	据	据					id
260.)	chu	qu	处	处					id
261.)	dui	dj	队	队		人			xm
262.)	nan	nv	南	南					id
263.)	gei	g^	给	给					id
264.)	se	s?	色	色					id
265.)	guang	g=	光	光					id
266.)	men	m)	门	门					id
267.)	ji	gr	即	即		耳			xm
268.)	bao	b+	保	保					id
269.)	zhi	\l	治	治	理				xb
270.)	bei	bn	北	北	南				xe/xb
271.)	zao	z+	造	造					id
272.)	bai	bf	百	百	分				xb
273.)	gui	gw	规	规					id
274.)	re	j?	熱	熱					id
275.)	ling	l1	领	领					id
276.)	qi	ki	七	七		一			ids/xm
277.)	hai	a9	海	海					exp
278.)	de	——	地				see	No 28	
279.)	kou	k[	口	口					id
280.)	dong	dh	东	东	西				xe/xb
281.)	dao	d5	导	导	师				xb
282.)	qi	uk	器	武	器				xb
283.)	ya	6	压	压					id
284.)	zhi	\k	志	志	氣				xb
285.)	shi	5ge	世	世	界				xb
286.)	jin	a2	金	进					exp
287.)	zeng	z#	增	增					exp
288.)	zheng	\#i	争	争	议				xb
289.)	ji	gn	济	济	南				xn
290.)	jie	geg	阶	阶	级				xb
291.)	you	8v	油	油		三点水			xm
292.)	si	sr	思	思	而后行				xe
293.)	shu	au	术	术					exp
294.)	ji	gd	极	极	端				xb
295.)	jiao	g@t	交	交	通				xb
296.)	shou	[k	受	受	氣				xb
297.)	lian	l3	联	联					id
298.)	shen	5)	什	什					id
299.)	ren	j)	認	認					id
300.)	liu	lk	六	六	氣				xb
301.)	gong	/v	共	共	产				xb
302.)	quan	k&l	權	權	利				xb
303.)	shou	[2	收	收	音				xb
304.)	zheng	\#m	证	证	明				xb

305.)	gai	g9	改	改			id
306.)	qing	k1v	清	清		三点水	xm
307.)	ji	zg	已	自	己		xb
308.)	mei	ml	美	美	丽		xb
309.)	zai	z9	再	再			id
310.)	cai	c9	采	采			id
311.)	zhuan	\7	转	转			id
312.)	geng	g#	更	更			id
313.)	dan	dc	单	单	词		xb
314.)	feng	f#	风	风			id
315.)	qie	ke	切	切			id
316.)	da	d*	打	打			id
317.)	bai	b9	白	白			id
318.)	jiao	g@0	教	教	育		xb
319.)	su	su	速	速			id
320.)	hua	h%	花	花			id
321.)	dai	dl	带	带	领		xb
322.)	an	v	安	安			id
323.)	chang	(d	场	场	地		xb
324.)	shen	))	身	身			ids
325.)	che	q?	车	车			id
326.)	li	lt	例	例	题		xb
327.)	zhen	\)	真	真			id
328.)	wu	ul	务	务		力	xm
329.)	ju	g0b	具	具	备		xb
330.)	wan	7	万	万			id
331.)	mei	mt	每	每	天		xb
332.)	mu	md	目	目	的		xb
333.)	zhi	\0	至	至	于		xb
334.)	da	db	达	达	卜		xe/xb
335.)	zou	z[	走	走			id
336.)	ji	gl	积	积	累		xb
337.)	shi	b5	示	表	示		xb
338.)	yi	il	议	议	论		xb
339.)	sheng	5#	声	声			id
340.)	bao	b\	报	报	纸		xb
341.)	dou	d\	斗	斗	志		xb
342.)	wan	7m	完	完			xm
343.)	lei	l^	类	类			id
344.)	ba	bl	八	八	路		xe
345.)	li	lb	离	离	别		xb
346.)	hua	%l	华	华	里		xb
347.)	ming	mz	名	名	字		xb
348.)	que	k]	確	確			id
349.)	cai	ac	才	才			exp
350.)	ke	k?	科	科			id
351.)	zhang	(/	张	张		弓长	xm
352.)	xin	h2f	信	信	封		xb
353.)	ma	m*	马	马			id
354.)	jie	gem	节	节	目		xb
355.)	hua	a%	话	话			exp

356.)	mi	mi	米	米			id
357.)	zheng	##	整	整			ids
358.)	kong	k/	空	空			id
359.)	yuan	&i	元	元		一	xm
360.)	kuang	k=	况	况			id
361.)	jin	g2t	今	今	天		xb
362.)	ji	gt	集	集	体		xb
363.)	wen	:v	温	温		三点水	xm
364.)	chuan	q7	传	传			id
365.)	tu	tt	土	土		土	ids/xb
366.)	xu	h0d	许	许	多		xb
367.)	bu	bz	步	步	子		xb
368.)	qun	k_	群	群			id
369.)	guang	a=	广	广			exp
370.)	shi	55	石	石			ids
371.)	ji	g\	记	记	者		xb
372.)	xu	h0	需	需			id
373.)	duan	d7	段	段			id
374.)	yan	3	研	研			id
375.)	jie	ge5	界	世	界		xb
376.)	la	l*	拉	拉			id
377.)	lin	l2	林	林			id
378.)	lü	l0	律	律			id
379.)	jiao	g@m	叫	叫	名		xb
380.)	qie	kem	且	且	慢		xb
381.)	jiu	3g8	究	研	究		xb
382.)	guan	g7d	观	观	点		xb
383.)	yue	]	越	越			id
384.)	zhi	\s	织	织		丝	xm
385.)	zhuang	\=	装	装			id
386.)	ying	1z	影	影	子		xb
387.)	suan	s7	算	算			id
388.)	di	dg	低	低	级	高	xb/xe
389.)	chi	q\	持	持	之	以恒	xe
390.)	yin	2]	音	音	乐		xb
391.)	zhong	/j	众	众		人	xm
392.)	shu	a5	书	书			exp
393.)	bu	bp	布	布	匹		xb
394.)	fu	fu	复	复			id
395.)	rong	j/	容	容			id
396.)	er	rz	儿	儿	子		xb
397.)	xu	h0\	须	须	知		xb
398.)	ji	gog	际	国	际		xb
399.)	shang	5(	商	商			id
400.)	fei	f^	非	非			id
401.)	yan	3m	验	验		马	xm
402.)	lian	lc	连	连	词		xb
403.)	duan	d0	断	断	语		xb
404.)	shen	)v	深	深		三点水	xm
405.)	nan	nt	难	难	题		xb
406.)	jin	g2&	近	近	远		xe

407.)	kuang	k=5	矿	矿		石	xm
408.)	qian	k37	千	千	万		xe
409.)	zhou	\[	周	周			id
410.)	wei	wn	委	委		女	xm
411.)	su	as	素	素			exp
412.)	ji	g5u	技	技	术		xb
413.)	bei	b4	备	备	用		xb
414.)	ban	bv	半	半			id
415.)	ban	b/	办	办	公		xb
416.)	qing	k1n	青	青	年		xb
417.)	sheng	5#f	省	省	份		xb
418.)	lie	le	列	列			id
419.)	xi	ht	习	习	题		xb
420.)	xiang	2hx	响	影	响		xb
421.)	yue	]s	约	约		丝	xm
422.)	zhi	\q	支	支	持		xb
423.)	ban	bb	般	百	般		xb
424.)	shi	5l	史	历	史		xb
425.)	gan	gvd	感	感	动		xb
426.)	lao	ld	劳	劳	动		xb
427.)	bian	b0	便	便	于		xb
428.)	tuan	t7	团	团			id
429.)	wang	=j	往	往		人	xm
430.)	suan	s7t	酸	酸	甜		xe
431.)	li	l5	历	历	史		xb
432.)	shi	5q	市	市	尺		xb
433.)	ke	?g	克	克	己		xb
434.)	he	?k	何	何	其		xb
435.)	chu	aq	除	除			exp
436.)	xiao	h@m	消	消	灭		xb
437.)	gou	g[	构	构			id
438.)	fu	fu#	府	政	府		xb
439.)	cheng	q#w	称	称	谓		xb
440.)	tai	t9	太	太			id
441.)	zhun	\:	准	准			id
442.)	jing	g1z	精	精	子		xb
443.)	zhi	\j	值	值		人	xm
444.)	hao	+m	号	号	码		xb
445.)	lü	bl0	率	比	率		xb
446.)	zu	zuj	族	族	人		xb
447.)	wei	ws	维	维		丝	xm
448.)	hua	h%i	划	划	一		xb
449.)	xuan	h&	选	选			id
450.)	biao	bm	标	标		木	xm
451.)	xie	hez	写	写	字		xb
452.)	cun	c:	存	存			id
453.)	hou	h[	候	候			id
454.)	mao	m+	毛	毛			id
455.)	qin	k2	親	親			id
456.)	kuai	ky	快	快			id
457.)	xiao	h@l	效	效	力		xb

458.)	si	s5	斯	斯	时				xb
459.)	yuan	&z	院	院	子				xb
460.)	cha	q*	查	查					id
461.)	jiang	gxh	江	江	西				xn
462.)	xing	h1+	型	型	号				xb
463.)	yan	31	眼	眼	泪				xb
464.)	wang	=	王	王					id
465.)	an	v[	按	按		手			xm
466.)	ge	?z	格	格	子				xb
467.)	yang	x0	养	养	育				xb
468.)	yi	ij	易	容	易				xb
469.)	zhi	w\	置	位	置				xb
470.)	pai	p9	派	派					id
471.)	ceng	c#	层	层					id
472.)	pian	p3	片	片					id
473.)	shi	5n	始	始		女			xm
474.)	que	a]	却	却					exp
475.)	zhuan	\7e	专	专	业				xb
476.)	zhuang	a\	状	状					exp
477.)	yu	0x	育	育	秧				xb
478.)	chang	(z	厂	厂	子				xb
479.)	jing	g1d	京	京	都				xb
480.)	shi	5z	识	识	字				xb
481.)	shi	51	适	适	应				xb
482.)	shu	5u0	属	属	于				xb
483.)	yuan	2&	圆	银	圆	元			xb/exp
484.)	bao	bw	包	包	围				xb
485.)	huo	hol	火	火	力				xb
486.)	zhu	\uf	住	住	房				xb
487.)	tiao	——	调				see	No 506	
488.)	man	mv	满	满					id
489.)	xian	h3)	县	县	城				xb
490.)	ju	g05	局	局	势				xb
491.)	zhao	\+	照	照					id
492.)	can	cv	参	参					id
493.)	hong	h/	红	红					id
494.)	xi	hs	细	细		丝			xm
495.)	yin	2/	引	引		弓			xm
496.)	ting	t1	听	听					id
497.)	gai	1g9	该	应	该				xb
498.)	tie	te	铁	铁					id
499.)	jia	g6j	价	价		人			xm
500.)	yan	3c	严	严	词				xb
501.)	shou	[d	首	首	都				xb
502.)	di	diz	底	底	子				xb
503.)	ye	ev	液	液		三点水			xm
504.)	guan	g7&	官	官	员				xb
505.)	de	d?	德	德					id
506.)	diao	d@	调	调					id
507.)	sui	sw	随	随					id
508.)	bing	bj	病	病	人				xb

509.)	su	su[	苏	苏	州	xb
510.)	shi	5b	失	失	败	xb
511.)	er	rj	尔	尔		ids
512.)	si	sj	死	死	人	xb
513.)	jiang	gx3	讲	讲	演	xb
514.)	pei	p^	配	配		id
515.)	nü	n0	女	女		id
516.)	huang	h=	黄	黄		id
517.)	tui	tw	推	推		id
518.)	xian	h35	显	显	示	xb
519.)	tan	tv	谈	谈		id
520.)	zui	zwj	罪	罪	人	xb
521.)	shen	)i	神	神	异	xb
522.)	yi	i5u	艺	艺	术	xb
523.)	ne	n?	呢	呢		id
524.)	xi	hm	席	毛	主 席	xn
525.)	han	hvi	含	含	义	xb
526.)	qi	kj	企	企	人	xm
527.)	wang	==	望	望		ids
528.)	mi	mg	密	密	集	xb
529.)	pi	pi	批	批		id
530.)	ying	1e	营	营	业	xb
531.)	xiang	hxb	项	项	背	xb
532.)	fang	fr	防	防	耳	xm
533.)	ju	g0d	举	举	动	xb
534.)	qiu	k8=	球	球	王	xm
535.)	ying	14	英	英	勇	xb
536.)	yang	xk	氧	氧	氣	xb
537.)	shi	5li	势	势	力	xb
538.)	gao	+\	告	告	知	xb
539.)	li	lm	李	李	木	xb
540.)	tai	tz	台	台	子	xb
541.)	luo	lo	落	落		id
542.)	mu	mu	木	木		id
543.)	bang	b(	帮	帮		id
544.)	lun	l:z	轮	轮	子	xb
545.)	po	p?	破	破		id
546.)	ya	6\[	亚	亚	洲	xb
547.)	shi	5f	师	师	傅	xb
548.)	wei	wk	围	围	棋	xb
549.)	zhu	\ui	注	注	意	xb
550.)	yuan	&g2	远	远	近	xb
551.)	zi	hvz	字	汉	字	xb
552.)	cai	c9l	材	材	料	xb
553.)	pai	pd	排	排	队	xb
554.)	gong	/x	供	供	养	xb
555.)	he	h?&	河	河	源	xb
556.)	tai	td	态	态	度	xb
557.)	feng	fb	封	封	闭	xb
558.)	ling	l1y	另	另	外	xb
559.)	shi	54	施	施	用	xb (ambig)

560.)	jian	g3d	减	减	低		xb
561.)	shu	5um	树	树	木		xb
562.)	rong	j/\	溶	溶	质		xb
563.)	zen	z)	怎	怎			id
564.)	zhi	t\	止	停	止		xb
565.)	an	vz	案	案	子		xb
566.)	yan	30	言	言	语		xb
567.)	shi	u5	士	武	士		xb
568.)	jun	g__	均	均	匀		xb
569.)	wu	u5u	武	武	术		xb
570.)	gu	gu	固	固			id
571.)	ye	ez	叶	叶	子		xb
572.)	yu	00	鱼	鱼			ids
573.)	bo	b?	波	波			id
574.)	shi	5t	视	视	听		xe
575.)	jin	g2\	仅	仅		只	xe
576.)	fei	f4	费	费	用		xb
577.)	jin	g1(	紧	紧	张		xb
578.)	ai	*9	爱	爱			exp/id
579.)	zuo	zo8	左	左	右		xb/xe
580.)	zhang	:(	章	文	章		xb
581.)	zao	+7	早	早	晚		xb/xe
582.)	chao	q+	朝	朝			id
583.)	hai	h9p	害	害	怕		xb
584.)	xu	h0g	续	续	集		xb
585.)	qing	k11	輕	輕	盈		xb
586.)	fu	if	服	衣	服		xb
587.)	shi	53	试	试	验		xb
588.)	shi	5iu	食	食	物		xb
589.)	chong	q/	充	充			id
590.)	bing	bk	兵	兵	器		xb
591.)	yuan	&5w	源	源		水	xe
592.)	pan	pv	判	判			id
593.)	hu	hu	护	护			id
594.)	si	sg	司	司	机		xb
595.)	zu	zui	足	足	以		xb
596.)	mou	m[	某	某			id
597.)	lian	l3h	练	练	习		xb
598.)	cha	q*i	差	差	异		xb
599.)	zhi	\c	致	致			xb
600.)	ban	b6	板	板	牙		xb
601.)	tian	t&	田	田	园		xb
602.)	jiang	gxk	降	降	旗		xb
603.)	hei	h^	黑	黑			id
604.)	fan	fzw	犯	犯	罪		xb
605.)	fu	fz?	负	负	责		xb
606.)	ji	gp	击	击	破		xb
607.)	fan	fvw	范	范	围		xb
608.)	ji	gf	继	继	父		xb
609.)	xing	h1=	兴	兴	旺		xb
610.)	si	shu	似	似	乎		xb

611.)	yu	0y	余	余	外		xb
612.)	jian	g35	坚	坚	实		xb
613.)	qu	k0\	曲	曲	直		xb
614.)	shu	_5u	输	运	输		xb
615.)	xiu	h8	修	修			id
616.)	di	——	的			see No 1	
617.)	gu	gu5	故	故	事		xb
618.)	cheng	q#5	城	城	市		xb
619.)	fu	fk	夫	夫	妻		xb
620.)	gou	[l	够	够	了		xe
621.)	song	s/	送	送			id
622.)	xiao	h@3	笑	笑	颜		xb
623.)	chuan	q7\	船	船	只		xb
624.)	zhan	\v8	占	占	有		xb
625.)	you	8b	右	右	边		xb
626.)	cai	c9u	财	财	务		xb
627.)	chi	qi	吃	吃			ids
628.)	fu	f0	富	富	裕		xb
629.)	chun	q:	春	春			id
630.)	zhi	\e	职	职	业		xb
631.)	jue	g]d	觉	觉	得		xb
632.)	han	hv	汉	汉			id
633.)	hua	h%r	画	画	儿		ids
634.)	gong	/g	功	功	绩		xb (rev)
635.)	ba	b=	巴	巴	望		xb
636.)	gen	)r	跟	跟	儿		xb
637.)	sui	swv	虽	虽	然		xb
638.)	za	z*	杂	杂			id
639.)	fei	fg	飞	飞	机		xb
640.)	jian	g3*	检	检	查		xb
641.)	xi	h5	吸	吸	食		xb
642.)	zhu	b\u	助	帮	助		xb
643.)	sheng	5#k	升	升	旗		xb
644.)	yang	tx	阳	太	阳		xb
645.)	hu	hul	互	互	利		xb
646.)	chu	quc	初	初	次		xb
647.)	chuang	q=	创	创			id
648.)	kang	k(	抗	抗			id
649.)	kao	k+	考	考			id
650.)	tou	t[\	投	投	掷		xb
651.)	huai	hy	坏	坏			id
652.)	ce	c?	策	策			id
653.)	gu	gud	古	古	代		xb
654.)	jing	g1\	径	径	直		xb
655.)	huan	h7	换	换			id
656.)	wei	wl	未	未	来		xb
657.)	pao	p+	跑	跑			id
658.)	liu	ln	留	留	念		xb
659.)	gang	g(	钢	钢			id
660.)	ceng	c#g	曾	曾	几 何 时		xe
661.)	duan	dd	端	端			ids

662.)	ze	fz	责	负	责		xb
663.)	zhan	\vk	站	站	起	来	xe
664.)	jian	g3i	简	简	易		xb
665.)	shu	5u\	述	述	职		xb
666.)	qian	k3b	錢	錢	币		xb
667.)	fu	fe	副	副	业		xb
668.)	jin	g25	尽	尽	是		xb
669.)	di	d=	帝	帝	王		xb
670.)	she	t5?	射	弹	射		xb
671.)	cao	c+	草	草			id
672.)	chong	q/g	冲	冲	积		xb
673.)	cheng	q#=	承	承	望		xb
674.)	du	dul	独	独	立		xb
675.)	ling	ml1	令	命	令		xb
676.)	xian	h30	限	限	于		xb
677.)	a	**	阿	阿			ids
678.)	xuan	h&b	宣	宣	布		xb
679.)	huan	h7z	环	环	子		xb
680.)	shuang	5=	双	双			id
684.)	rang	j(	讓	讓			id
690.)	fou	f[	否	否			id
691.)	ji	gn3	纪	纪	念		xb
701.)	zuo	zow	坐	坐	位		xb
702.)	fen	f)	粉	粉			id
704.)	lüe	l]	略	略			id
707.)	leng	l#	冷	冷			id
712.)	ji	7g	剂	丸	剂		xb
718.)	nian	n3	念	念			id
719.)	chen	q)	陈	陈			id
720.)	reng	j#	仍	仍			id
725.)	cuo	co	错	错			id
726.)	ku	ku	苦	苦			id
733.)	hun	h:	混	混			id
743.)	ji	gd1	既	既	定		xb
751.)	xun	h_	迅	迅			id
752.)	hang	——	行			see No 57 or h(nyc	
754.)	ruo	ro	若	若			id
758.)	kuo	ko	括	括			id
759.)	ji	gk	激	激	起		xb
774.)	wei	wk[	味	味	口		xm
776.)	mo	mo	模	模			id
779.)	sun	s:	损	损			id
783.)	pu	pu	普	普			id
795.)	na	n*k	拿	拿	起		xb
805.)	ji	gpo	急	急	迫		xb
811.)	fu	fd	附	附	带		xb
818.)	tuo	to	脱	脱			id
820.)	zhang	\(o	掌	掌	握		xb
822.)	long	l/	龙	龙			id
824.)	fu	ff	父	父			ids
831.)	sha	5*	沙	沙			id

836.)	dun	d:	盾	盾		id
837.)	tao	t+	讨	讨		id
838.)	wan	75(	晚	晚	上	xb
840.)	luan	l7	乱	乱		id
846.)	ning	n1	宁	宁		id
851.)	du	du3	读	读	言	xm
860.)	wo	o5[	握	握	手	xb
861.)	lan	lv	兰	兰		id
872.)	shun	5:	顺	顺		id
874.)	suo	so	缩	缩		id
880.)	kun	k:	困	困		id
885.)	fu	7f	福	万	福	xb
886.)	mai	m9	买	买		id
891.)	pa	p*	怕	怕		id
896.)	cu	cu	促	促		id
899.)	ping	p1	評	評		id
901.)	rou	j[	肉	肉		id
905.)	kuan	k7	宽	宽		id
911.)	chui	qw	垂	垂		id
925.)	niu	n8	牛	牛		id
933.)	zhua	\%	抓	抓		id
937.)	niang	nx	娘	娘		id
943.)	meng	m#	盟	盟		id
944.)	heng	h#	衡	衡		id
945.)	ji	g/g	鸡	公	鸡	xb
962.)	nai	n9	耐	耐		id
968.)	ji	sg	季	四	季	xb
972.)	e	??	额	额		ids
975.)	juan	g&	卷	卷		id
979.)	ke	k?b	课	课	本	xb
981.)	zong	z/	宗	宗		id
982.)	miao	m@	苗	苗		id
1007.)	tu	tuc	途	途	次	xb
1008.)	mie	me	灭	灭		id
1009.)	sai	s9	賽	賽		id
1023.)	tang	t(	糖	糖		id
1026.)	fu	fh+	符	符	号	xb
1028.)	nu	nu	努	努		id
1032.)	run	j:	潤	潤		id
1033.)	fu	fu&	幅	幅	员	xb
1034.)	ha	h*	哈	哈		id
1039.)	nao	n+	脑	脑		id
1042.)	ou	[[	欧	欧		ids
1045.)	zhai	\9	寨	寨		id
1057.)	zhe	\?\	折	折	纸	xb
1062.)	wa	%%	瓦	瓦		id
1075.)	ji	ghx	迹	迹	象	xb
1076.)	ka	k*	卡	卡		id
1078.)	yu	0d+	遇	遇	到	xb
1091.)	mang	m(	忙	忙		id
1101.)	chou	q[	抽	抽		id

1107.) zhui	\w	追	追		id
1109.) xiong	h4	雄	雄		id
1113.) lou	l[	楼	楼		id
1122.) dian	cd3	典	词 典		xb
1150.) pang	p(	旁	旁		id
1161.) ci	cid	词	词 典		xb
1173.) qiao	k@	橋	橋		id
1174.) fu	fn0	妇	妇 女		xb
1179.) fu	f2	付	付 印		xb
1180.) fu	f5w	浮	浮 水		xb
1183.) nin	n2	您	您		id
1186.) zan	zv	赞	赞		id
1210.) en	a)	恩	恩		ids
1233.) lang	l(	朗	朗		id
1236.) cang	c(	藏	藏		id
1239.) fu	dfu	腐	豆 腐		xb
1248.) zha	*	扎	扎		id
1258.) sa	s*	薩	薩		id
1263.) pen	p)	喷	喷		id
1267.) gua	g%	挂	挂		id
1278.) ruan	j7	軟	軟		id
1281.) gun	g:	滚	滚		id
1285.) ken	k)	肯	肯		id
1299.) zuan	z7	钻	钻		id
1300.) le	l?	勒	勒		id
1308.) fu	fut	伏	伏 天		xb
1312.) ca	c*	擦	擦		id
1334.) rao	j+	繞	繞		id
1338.) ji	wg	绩	伟 绩		xb
1339.) peng	p#	朋	朋		id
1344.) chai	q9	柴	柴		id
1350.) wang	=g	忘	忘 记		xb
1351.) beng	b#	泵	泵		id
1367.) zun	z:	尊	尊		id
1377.) rui	jw	瑞	瑞		id
1378.) guai	gy	怪	怪		id
1389.) qiong	k4	窮	窮		id
1390.) sen	s)	森	森		id
1394.) cui	cw	催	催		id
1431.) li	mli	丽	美 丽		xb
1432.) kua	k%	跨	跨		id
1455.) shuai	——	率		see No 445 or 5y nyc	
1460.) ji	8g	寄	邮 寄		xb
1470.) die	de	爹	爹		id
1492.) zhuo	\o	桌	桌		id
1529.) piao	p@	票	票		id
1535.) qia	k6	恰	恰		id
1540.) teng	t#	腾	腾		id
1565.) fu	fuw	抚	抚 慰		xb
1574.) ji	gn9	挤	挤 奶		xb
1581.) ji	gl2	吉	吉 林		xn

1597.) nuan	n7	暖	暖		id
1608.) bin	b2	宾	宾		id
1620.) ji	5ug	籍	书 籍		xb
1664.) shai	59	筛	筛		id
1680.) nen	n)	嫩	嫩		id
1686.) ao	++	奥	奥		id
1701.) fu	fud	辅	辅 导		xb
1709.) niao	n@	鸟	鸟		id
1757.) ji	b3g	辑	编 辑		xb
1769.) shua	5%	刷	刷		id
1772.) fu	fu5	赋	赋 诗		xe
1774.) fo	f?	佛	佛		id
1781.) fu	fx	扶	抚 养		xb
1785.) kui	kw	亏	亏		id
1789.) fu	fu=	覆	覆 亡		xb
1804.) ji	gb1	疾	疾 病		xb
1813.) sang	s(	桑	桑		id
1819.) zang	z(	脏	脏		id
1825.) ji	gr[	肌	肌 肉		xb
1846.) keng	k#	坑	坑		id
1882.) sou	s[	搜	搜		id
1883.) fu	——	佛		see No 1774	
1925.) fu	fun	赴	赴 难		xb
1940.) fu	5fu	傅	师 傅		xb
1941.) fu	gof	腹	果 腹		xb
1949.) diu	d8	丢	丢		id
1952.) ang	a(	昂	昂		id
2009.) lia	l6	俩	俩		id
2026.) sao	s+	嫂	嫂		id
2069.) tun	t:	吞	吞		id
2083.) ji	gi?	饥	饥 饿		xb
2100.) cuan	c7	篡	篡		id
2113.) fu	fh%	氟	氟 化		xb
2173.) zei	z^	贼	贼		id
2191.) ji	——	奇		see qi No 1070 nyc	
2210.) fu	ft@	辐	辐 条		xb
2238.) ji	kug	寂	枯 寂		xb
2264.) miu	m8	谬	谬		id
2266.) pou	p[	剖	剖		id
2267.) cou	c[	凑	凑		id
2295.) yi	iz	椅	椅 子		xb
2305.) nang	n(	囊	囊		id
2345.) ji	g5v	岌	岌 山 山		xe/xm
2362.) fu	fug	缚	缚 鸡		xe
2365.) fu	fu(	甫	甫 刚		xe
2406.) weng	a/	翁	翁		id
2466.) fu	fup	肤	肤 皮 潦 草		xe
2478.) ji	gd3	祭	祭 奠		xb
2488.) nie	ne	蘖	蘖		id
2495.) fu	ful	俘	俘 虏		xb
2514.) yo	8[	哟	哟		ids

2515.) ji	glx	脊	脊梁			xb
2631.) shuan	57	拴	拴			id
2639.) ji	gdu	忌	忌妒			xb
2641.) o	o?	哦	哦			ids
2648.) fu	fju	弗	自愧弗如			xe
2649.) fu	f5[	俯	俯首			xb
2679.) ji	hg	冀	希冀			xb
2705.) pin	p22	拼	拼音			xb
2733.) ji	gh0	亟	亟须纠正			xe
2776.) fu	fu@	敷	敷药			xb
2786.) ji	ug	姬	舞姬			xb
2790.) seng	s#	僧	僧			id
2809.) ji	——	给		see	No 263	
2827.) fu	)fu	咐	吩咐			xb
2854.) fu	fl7	孵	孵卵			xb
2881.) ji	gt/	唧	唧筒			xb
2882.) ji	——	其		see	No 112	
2900.) fu	fdi	釜	釜底游鱼			xe
2937.) fu	pfu	拂	披拂			xb
2963.) pie	pe	撇	撇			id
2966.) ji	——	辑		see	No 1757	
3029.) ga	g*	噶	噶			id
3066.) ji	gh1	畸	畸形			xb
3069.) nüe	n]	虐	虐			id
3075.) fu	fuz	斧	斧子			xb
3103.) ji	g5[	棘	棘手			xb
3158.) ji	gil	伎	伎俩			xb
3200.) ji	gq*	稽	稽查			xb
3296.) fu	bfu	袱	包袱			xb
3325.) ji	h=g	鲫	黄鲫			xn
3341.) cen	c)	岑	岑			id
3334.) fu	fu0	鲋	鲋鱼			xm
3346.) fu	fpi	麸	麸皮			xn
3347.) fu	ufu	阜	物阜民丰			xe
3431.) ji	g5#	叽	叽声			xe
3497.) ji	gn0	妓	妓女			xb
3498.) ji	——	系		see	No 172	
3542.) chuo	qo	绰	绰			id
3557.) fu	fh2	孚	孚			xe
3583.) chuai	qy	揣	揣			id
3588.) ji	gbv	羁	羁绊			xb
3603.) ji	gh)	嫉	嫉恨			xb
3604.) ji	gd[	箕	斗箕			xb
3618.) ji	g\u	笈	笈竹			xm
3619.) ji	gb?	瘠	瘠薄			xb
3641.) ji	gc	讥	讥刺			xb
3700.) ji	l(g	籍	狼籍			xb
3716.) jiong	g4	迥	迥			id
3718.) nuo	no	糯	糯			id
3731.) ji	g5w	汲	汲水			xm
3732.) ji	l+g	犄	老犄伏枥			xe

3772.) ji	h2g	悸	心 悸				xb/xm	
3773.) ji	g1g	饑	京 饑				xb	
3777.) ji	l*g	圾	垃 圾				xb	
3870.) fu	fj/	芙	芙 蓉				xn	
3886.) fu	z(f	腑	脏 腑				xb	
3915.) ji	5?g	稷	社 稷				xb	
3989.) ji	3g	蓟	烟 蓟				xm	
4005.) zhuai	\y	揣	揣				id	
4017.) ji	gi0	覬	覬 覦				xb	
4018.) ji	kg	戟	繁 戟				xn	
4110.) ji	ghh	*1					xb	
4171.) fu	fum	驸	驸 马	马			xb/xe	
4176.) ji	——	*2			see mei		nyc	
4205.) ji	gg2	暨	暨 今				xb	
4206.) ji	——	费			see lai		nyc	
4248.) fu	f5	砩	砩 石	石			xn/xm	
4249.) fu	fur	邪	邪	耳			xm	
4306.) fu	fuf	馥	馥 馥				xb	
4310.) ji	gk0	*3					xb	
4311.) ji	gpi	羁	羁 皮				xb	
4407.) ji	c+g	屐	草 屐				xb	
4408.) ji	gmu	*4		木			xb/xm	
4454.) ji	\[g	楫	舟 楫				xb	
4455.) ji	gli	蒺	蒺 藜				xb	
4495.) fu	fnv	呋	呋 喃				xb	
4498.) ji	gg]	剞	剞 劂				xb	
4499.) ji	gtu	*5		土			xe	
4575.) ji	gk(	嵇	嵇 康				xn	
4625.) fu	fpu	匍	匍 匐				xb	
4722.) fu	f\(	拊	拊 掌				xb	
4723.) fu	fkj	*6		人			xe	
4790.) fu	fgx	涪	涪 江				xn	
4796.) ji	gfu	*7		福			xe	
4797.) ji	gd+	洎	洎				xe	
4798.) ji	gm*	*8		马			xe	
4857.) fu	fuc	鬼	鬼 祇				xb	
4922.) fu	fub	蝠	蝙 蝠				xb	
4923.) fu	——	*9			see No 2470 and			No 2649
4929.) ji	gnu	戢	戢 怒				xb	
4941.) lo	l??	咯	咯				ids	
5012.) fu	ft[	幞	幞 头				xb	
5013.) fu	fh3	*10					xn	
5019.) ji	gg@	犄	犄 角				xb	
5020.) ji	gn1	荠	荠	*14			xb	
5101.) fu	ffu	*11	佛	繁体字			ids	
5185.) fu	f5?	蝮	蝮 蛇				xn	
5192.) ji	f*g	髻	发 髻				xe	
5193.) ji	——	齑			see No 976		nyc	
5194.) ji	gh9	*12		海			xe	
5301.) ji	gj)	佶	佶	人			xm/xe	
5302.) ji	gd#	跻	跻				xe	

5303.) ji	gg7	丌	丌官			xb
5304.) ji	gl*	掎	掎	拉		xe
5395.) fu	f(f	*13				xn
5397.) fu	fu:	讣	讣闻			xb
5411.) ji	d@g	矶	钓矶			xb
5412.) ji	gp?	急			gp & ?	xe/xm
5413.) ji	ggu	咭	咭咭呱呱			xe
5414.) ji	——	期			see No 236	
5504.) fu	fui	*14				xb
5505.) fu	fu8	蜉	蜉蝣			xn
5506.) fu	fus	*15		思		xb
5517.) ji	0g	霏	霏	雨		xm
5518.) ji	gto	偈	偈陀			xb
5628.) fu	fbv	*16				xn
5640.) ji	gq[	*17		稠		xe
5708.) tei	t^	忒	忒			id
5795.) fu	fuu	*18				ids
5796.) fu	fuy	稃	稃外			xb
5814.) ji	g\u	玑	珠玑			xb
5815.) ji	gi3	诘			see also jie	nyc
5816.) ji	bvg	*19		斑		xe
5980.) dia	d6	嗲	嗲			id
5987.) fu	fb^	*20		被		xb
5988.) fu	fgu	桴	桴鼓			xb
5989.) fu	fjv	桴	桴然			xb
6013.) ji	wgi	*20a			wg & i	xe/xm
6014.) ji	gc9	戢	戢菜			xb
6015.) ji	3gi	*21		燕		xn
6200.) fu	ff(	*22		房		xb
6201.) fu	——	獻			see No 5795	
6202.) fu	f84	*23				xe
6203.) fu	fqu	祓	祓除			xb
6204.) fu	fu]	*24				xb
6222.) ji	gf)	畬	畬粉			xb
6223.) ji	g0g	*25		踞		xb
6224.) ji	f#g	鲚	凤鲚			xn
6271.) nou	n[	耨	耨			id
6457.) fu	fux	滠	滠阳			xb
6458.) fu	——	绂			see No 5795	
6459.) fu	f5i	*26		食		xb
6487.) ji	5vg	嵴	嵴	山		xm/xb
6547.) m	am	*27				exp
6768.) fu	fu^	赙			arbitary	exp
6769.) fu	fzo	黼	黼座			xb
6770.) fu	lfu	*28		莱		xn
6771.) fu	f\u	*29		注		xb
6772.) fu	fuo	*30		坐		xb
6819.) ji	fgi	乩	扶乩			xb
6820.) ji	zgi	*31				xb
6821.) ji	gl1	*32				xb
6822.) ji	g\e	*33		只也		xcl

6823.) ji	gh2	*34		心			xm
6824.) ji	gir	*35		儿			xe
6825.) ji	g\i	笄	笄 蛭				xn
6826.) ji	gm+	*36		毛			xe
6853.) kei	k^	*37					id
7081.) zhong	\/9	钟	钟 爰				xb
7193.) den	d)	*38					id
7219.) fu	f5k	*39		食 器			xe
7220.) fu	fc+	*40		艹			xm
7221.) fu	——	市			see	No 5795	
7222.) fu	fg6	荸	蔑 荸				xn
7223.) fu	fb+	鳆	鳆				xe
7224.) fu	fg3	苻	苻 健				xn
7225.) fu	——	*41			see	bo	nyc
7226.) fu	——	*42			see	tiao	nyc
7304.) ji	gc+	茤	茤	艹			xm
7305.) ji	l^g	癪	雷 癪				xb
7306.) ji	gh?	芰	芰 荷				xn
7307.) ji	——	革			see	No 195	
7308.) ji	\vg	*43		站 立			xe

II.a List of missing characters

*1	4110.) ji	ghh	塅	休息
*2	4176.) ji	—	穊	
*3	4310.) ji	gk0	畀	畀奸
*4	4408.) ji	gmu	櫅	木
*5	4499.) ji	gtu	垣	土
*6	4723.) fu	fkj	伕	人
*7	4796.) ji	gfu	礽	福
*8	4798.) ji	gm*	靮	马
*9	4923.) fu	—	俛	
*10	5013.) fu	fh3	鄪	县
*11	5101.) fu	ffu	彿	佛
*12	5194.) ji	gh9	魡	海
*13	5395.) fu	f(f	鮒	魴鮒
*14	5504.) fu	fui	芾	芾菅
*15	5506.) fu	fus	罘	罘思
*16	5628.) fu	fbv	蚹	蚹蜈

*17	5640.) ji	gq[	概	稠
*18	5795.) fu	fuu	鞁	
*19	5816.) ji	bvg	鳚	斑鳚
*20	5987.) fu	fb^	襆	襆被
*20a	6013.) ji	wgi	勣	
*21	6015.) ji	3gi	姞	燕姞
*22	6200.) fu	ff(	栿	栿房
*23	6202.) fu	f84	浮	游泳
*24	6204.) fu	fu]	鈇	鈇钺
*25	6223.) ji	g0g	蹐	踼蹐
*26	6459.) fu	f5i	衬	衬食
*27	6547.) m	am	呣	
*28	6770.) fu	lfu	菔	菜菔
*29	6771.) fu	f\u	跗	跗注
*30	6772.) fu	fuo	趺	趺坐
*31	6820.) ji	zgi	錤	镃錤
*32	6821.) ji	gll	鶨	鶨鴿

*33	6822.) ji	g\e	觭	觭，只也。
*34	6823.) ji	gh2	恭	心
*35	6824.) ji	gir	積	褶儿
*36	6826.) ji	gm+	羁	羁毛
*37	6853.) kei	k^	克	
*38	7193.) den	d)	扽	
*39	7219.) fu	f5k	簠	食器
*40	7220.) fu	fc+	芾	艹
*41	7225.) fu	—	怫	
*42	7226.) fu	—	烦	
*43	7308.) ji	\vg	倚	站立

II.1. List of one-cell units

Column I: Frequency according to xiandai hanyu zipin tongjibiao (Guojia Yuyan Wenzi Gongzuoweiyuanhui, 1992).

Column II: Sound of the code, according to hanyu pinyin.

Column III: Pronounciation of the represented character, according to hanyu pinyin.

Column IV: Chinese character code according to ASCII. For translation into Braille cell forms see list 3.3.1. For translation into sounds see list 3.3.

Column V: Total number of occurrences according to xiandai hanyu zipin tongjibiao (Guojia Yuayan Wenzi Gongzuoweiyuanhui, 1992).

Column VI: Total number of occurrences according to xiandai hanyu pinlü zidian (Beijing Yuyan Xueyuan, 1986).

I	II	III	IV	V	VI
1.)	(d)	de	$ d	485786	75306
2.)	(yi)	yi	$ i	166396	33217
3.)	(shi)	shi	$ 5	139814	27611
4.)	(z)	zai	$ 9	120984	19442
5.)	(b)	bu	$ b	107418	24773
6.)	(l)	le	$ l	100718	30848
7.)	(you)	you	$ 8	99357	17762
8.)	(h)	he	$ h	86760	9690
9.)	(r)	ren	$ j	81106	17585
10.)	(zh)	zhe	$ \	77967	16749
11.)	(ong)	zhong	$ /	71491	5131
12.)	(a)	da	$ *	69640	12281
13.)	(wei)	wei	$ w	68012	6575
14.)	(ang)	shang	$ (	67837	12961
15.)	(g)	ge	$ g	65256	13630
17.)	(wo)	wo	$ o	61492	23226
19.)	(yao)	yao	$ @	57362	9203
20.)	(t)	ta	$ t	55710	16043
23.)	(yong)	yong	$ 4	53349	5201
24.)	(m)	men	$ m	51653	14961
25.)	(eng)	sheng	$ #	50590	6212
26.)	(ao)	dao	$ +	50519	10388
29.)	(yu)	yu	$ 0	44346	3617
30.)	(ch)	chu	$ q	43767	6986
32.)	(en)	fen	$)	43498	3747
36.)	(k)	ke	$?	40754	6211
38.)	(f)	fa	$ f	38502	4922
39.)	(n)	nian	$ n	38389	5768
43.)	(ie)	ye	$ e	37737	7389
47.)	(zi)	zi	$ z	36040	9227
52.)	(er)	er	$ r	33754	3649
54.)	(ou)	hou	$ [	33425	4524
60.)	(s)	suo	$ s	31158	2650
62.)	(ei)	dei	$ ^	30517	7482
78.)	(ua)	hua	$ %	26767	2425
83.)	(qi)	qi	$ k	25550	5798
85.)	(wu)	wu	$ u	24803	2580
105.)	(ying)	ying	$ 1	21837	1769
110.)	(yin)	yin	$ 2	21334	1952
116.)	(wai)	wai	$ y	20779	2468
125.)	(p)	ping	$ p	20070	1627
131.)	(yang)	yang	$ x	19551	4713
146.)	(yuan)	yuan	$ &	17518	1828
159.)	(ci)	ci	$ c	16270	1134
166.)	(wen)	wen	$:	15535	2989
239.)	(yun)	yun	$ _	11675	1261
283.)	(ya)	ya	$ 6	9758	702
322.)	(an)	an	$ v	8746	739
330.)	(wan)	wan	$ 7	8551	1403

374.)	(yan)	yan	$ 3	7621	1248
383.)	(yue)	yue	$]	7405	1001
464.)	(wang)	wang	$ =	5750	314
				2.902.608	508.554
of				11.873.029	1.808.114
				= 24.44%	= 28.1%

II.2. List of units which are identical to existing two-cell units

Column 1: Frequency according to *xiandai hanyu zipin zongjibiao* (Guojia Yuyan Wenzi Gongzuoweiyuanhui, 1992)

Column 2: Total number of occurrences according to *xiandai hanyu zipin tongjibiao* (Guojia Yuayan Wenzi Gongzuoweiyuanhui, 1992).

Column 3: Pronounciation of the represented character, according to *hanyu pinyin.*

Column 4: Chinese character code according to ASCII. Each code is preceeded by the sign $. For translation into Braille cell forms see list 3.3.1. For translation into sounds see list 3.3.

Units of identical sound

22.)	53984	lai	$ l9	106.)	21837	kai	$ k9
27.)	46623	zuo	$ zo	107.)	21477	ta	$ t*
28.)	46365	di	$ di	108.)	21425	he	$ h?
31.)	43623	jiu	$ g8	109.)	21339	hai	$ h9
33.)	42008	dui	$ dw	113.)	20931	xie	$ he
34.)	41881	cheng	$ q#	114.)	20905	ran	$ jv
35.)	41564	hui	$ hw	115.)	20805	qian	$ k3
37.)	38619	zhu	$ \u	117.)	20743	tian	$ t3
40.)	38247	dong	$ d/	118.)	20507	zheng	$ \#
41.)	38226	tong	$ t/	119.)	20420	si	$ si
42.)	37987	gong	$ g/	120.)	20404	ri	$ ji
44.)	36979	neng	$ n#	121.)	20323	na	$ n*
45.)	36591	xia	$ h6	122.)	20293	she	$ 5?
46.)	36103	guo	$ go	127.)	19837	xiang	$ hx
48.)	35844	shuo	$ 5o	128.)	19790	quan	$ k&
49.)	35614	chan	$ qv	129.)	19749	biao	$ b@
50.)	35049	zhong	$ \/	130.)	19627	jian	$ g3
51.)	33930	mian	$ m3	133.)	19202	guan	$ g7
53.)	33578	fang	$ f(	134.)	19188	ge	$ g?
55.)	33033	duo	$ do	136.)	19114	xin	$ h2
56.)	32368	ding	$ d1	138.)	18629	nei	$ n^
57.)	32053	xing	$ h1	139.)	18339	shu	$ 5u
58.)	31893	xue	$ h]	142.)	17989	fan	$ fv
59.)	31810	fa	$ f*	143.)	17828	ni	$ ni
61.)	30971	min	$ m2	144.)	17766	ming	$ m1
63.)	30014	jing	$ g1	145.)	17592	kan	$ kv
65.)	29373	san	$ sv	148.)	17457	me	$ m?
66.)	29331	zhi	$ \i	150.)	17210	bi	$ bi
67.)	29317	jin	$ g2	151.)	17124	huo	$ ho
69.)	29061	deng	$ d#	152.)	17042	dan	$ dv
70.)	28458	bu	$ bu	157.)	16573	dao	$ d+
71.)	28420	du	$ du	160.)	16231	bian	$ b3
72.)	27955	jia	$ g6	161.)	15631	tiao	$ t@
73.)	27905	dian	$ d3	163.)	15879	mei	$ m^
75.)	27270	li	$ li	164.)	15708	jie	$ ge
76.)	27113	ru	$ ju	172.)	15191	xi	$ hi
77.)	26774	shui	$ 5w	173.)	15119	jun	$ g_
79.)	26021	gao	$ g+	174.)	15095	hen	$ h)
84.)	25324	xiao	$ h@	175.)	15039	qing	$ k1
86.)	24651	xian	$ h3	176.)	14965	zhe	$ \?
89.)	24288	liang	$ lx	177.)	14712	zui	$ zw
90.)	24196	dou	$ d[	179.)	14688	dai	$ d9
92.)	23974	ti	$ ti	183.)	14496	bing	$ b1
95.)	23506	dang	$ d(	189.)	14038	zhan	$ \v
98.)	22644	cong	$ c/	192.)	13744	liao	$ l@
100.)	22444	ben	$ b)	198.)	13407	chang	$ q(
101.)	22195	qu	$ k0	202.)	13263	pin	$ p2
102.)	22167	ba	$ b*	208.)	12997	te	$ t?
104.)	22037	hao	$ h+	211.)	12924	qiu	$ k8

212.)	12882	lao	$ l+	325.)	8602	che	$ q?
213.)	12823	tou	$ t[	327.)	8590	zhen	$ \)
217.)	12369	liu	$ l8	335.)	8419	zou	$ z[
218.)	12364	lu	$ lu	339.)	8398	sheng	$ 5#
220.)	12267	shao	$ 5+	343.)	8294	lei	$ l^
221.)	12196	tu	$ tu	348.)	8082	que	$ k]
222.)	12193	shan	$ 5v	350.)	8062	ke	$ k?
226.)	12013	jiao	$ g@	353.)	8025	ma	$ m*
227.)	12960	zhang	$ \#	356.)	7939	mi	$ mi
	12007			358.)	7886	kong	$ k/
228.)	11972	jiang	$ gx	360.)	7840	kuang	$ k=
229.)	11963	zu	$ zu	364.)	7760	chuan	$ q7
232.)	11902	bie	$ be	368.)	7702	qun	$ k_
234.)	11757	shou	$ 5[	372.)	7638	xu	$ h0
237.)	11698	gen	$ g)	373.)	7631	duan	$ d7
238.)	11693	lun	$ l:	376.)	7501	la	$ l*
240.)	11623	nong	$ n/	377.)	7495	lin	$ l2
242.)	11493	ji	$ gi	378.)	7466	lü	$ l0
245.)	11350	qiang	$ qx	385.)	7355	zhuang	$ \=
247.)	11323	jue	$ g]	387.)	7324	suan	$ s7
249.)	11311	bei	$ b^	394.)	7131	fu	$ fu
250.)	11206	gan	$ gv	395.)	7130	rong	$ j/
256.)	10885	ze	$ z?	399.)	6948	shang	$ 5(
259.)	10714	ju	$ g0	400.)	6917	fei	$ f^
260.)	10611	chu	$ qu	409.)	6714	zhou	$ \[
262.)	10540	nan	$ nv	414.)	6674	ban	$ bv
263.)	10507	gei	$ g^	418.)	6614	lie	$ le
264.)	10475	se	$ s?	428.)	6464	tuan	$ t7
265.)	10427	guang	$ g=	437.)	6263	gou	$ g[
266.)	10372	men	$ m)	440.)	6228	tai	$ t9
268.)	10325	bao	$ b+	441.)	6215	zhun	$ \:
271.)	10274	zao	$ z+	449.)	5936	xuan	$ h&
273.)	10109	gui	$ gw	452.)	5909	cun	$ c:
274.)	10075	re	$ j?	453.)	5888	hou	$ h[
275.)	10071	ling	$ l1	454.)	5861	mao	$ m+
279.)	9913	kou	$ k[	455.)	5858	qin	$ k2
287.)	9694	zeng	$ z#	456.)	5856	kuai	$ ky
297.)	9442	lian	$ l3	460.)	5797	cha	$ q*
298.)	9399	shen	$ 5)	470.)	5629	pai	$ p9
299.)	9387	ren	$ j)	471.)	5616	ceng	$ c#
305.)	9117	gai	$ g9	472.)	5616	pian	$ p3
309.)	9046	zai	$ z9	488.)	5431	man	$ mv
310.)	9035	cai	$ c9	491.)	5387	zhao	$ \+
311.)	9015	zhuan	$ \7	492.)	5386	can	$ cv
312.)	8995	geng	$ g#	493.)	5365	hong	$ h/
314.)	8908	feng	$ f#	496.)	5281	ting	$ t1
315.)	8890	qie	$ ke	498.)	5267	tie	$ te
316.)	8864	da	$ d*	505.)	5159	de	$ d?
317.)	8855	bai	$ b9	506.)	5158	diao	$ d@
319.)	8847	su	$ su	507.)	5154	sui	$ sw
320.)	8826	hua	$ h%	514.)	5084	pei	$ p^

515.)	5064	nü	$	n0	758.)	2840	kuo	$	ko
516.)	5057	huang	$	h=	776.)	2742	mo	$	mo
517.)	5054	tui	$	tw	779.)	2724	sun	$	s:
519.)	5018	tan	$	tv	783.)	2700	pu	$	pu
523.)	4984	ne	$	n?	818.)	2560	tuo	$	to
529.)	4904	pi	$	pi	822.)	2542	long	$	l/
541.)	4727	luo	$	lo	831.)	2494	sha	$	5*
542.)	4716	mu	$	mu	836.)	2471	dun	$	d:
543.)	4410	bang	$	b(	837.)	2471	tao	$	t+
545.)	4688	po	$	p?	840.)	2443	luan	$	l7
563.)	4550	zen	$	z)	846.)	2404	ning	$	n1
570.)	4492	gu	$	gu	861.)	2340	lan	$	lv
573.)	4467	bo	$	b?	872.)	2320	shun	$	5:
578.)	4429	ai	$	*9	874.)	2309	suo	$	so
582.)	4381	chao	$	q+	880.)	2279	kun	$	k:
589.)	4325	chong	$	q/	886.)	2261	mai	$	m9
592.)	4300	pan	$	pv	891.)	2243	pa	$	p*
593.)	4262	hu	$	hu	896.)	2204	cu	$	cu
596.)	4235	mou	$	m[	899.)	2197	ping	$	p1
603.)	4158	hei	$	h^	901.)	2195	rou	$	j[
615.)	4018	xiu	$	h8	905.)	2175	kuan	$	k7
621.)	3938	song	$	s/	911.)	2152	chui	$	qw
627.)	3884	chi	$	qi	925.)	2111	niu	$	n8
629.)	3878	chun	$	q:	933.)	2090	zhua	$	\%
632.)	3842	han	$	hv	937.)	2075	niang	$	nx
638.)	3779	za	$	z*	943.)	2063	meng	$	m#
647.)	3676	chuang	$	q=	944.)	2056	heng	$	h#
648.)	3665	kang	$	k(	962.)	1994	nai	$	n9
649.)	3657	kao	$	k+	972.)	1978	e	$	??
651.)	3653	huai	$	hy	975.)	1969	juan	$	g&
652.)	3652	ce	$	c?	981.)	1944	zong	$	z/
655.)	3635	huan	$	h7	982.)	1943	miao	$	m@
657.)	3619	pao	$	p+	1008.)	1845	mie	$	me
659.)	3607	gang	$	g(	1009.)	1845	sai	$	s9
671.)	3539	cao	$	c+	1028.)	1799	nu	$	nu
677.)	3492	a	$	**	1023.)	1793	tang	$	t(
680.)	3464	shuang	$	5=	1032.)	1787	run	$	j:
684.)	3392	rang	$	j(	1034.)	1781	ha	$	h*
690.)	3257	fou	$	f[	1039.)	1764	nao	$	n+
702.)	3213	fen	$	f)	1042.)	1758	ou	$	[[
704.)	3204	lüe	$	l]	1045.)	1756	zhai	$	\9
707.)	3192	leng	$	l#	1062.)	1705	wa	$	%%
718.)	3134	nian	$	n3	1076.)	1676	ka	$	k*
719.)	3130	chen	$	q)	1091.)	1632	mang	$	m(
720.)	3129	reng	$	j#	1101.)	1604	chou	$	q[
725.)	3067	cuo	$	co	1107.)	1585	zhui	$	\w
726.)	3062	ku	$	ku	1109.)	1578	xiong	$	h4
733.)	3011	hun	$	h:	1113.)	1571	lou	$	l[
751.)	2869	xun	$	h_	1150.)	1483	pang	$	p(
752.)	2864	hang	$	h(	1173.)	1431	qiao	$	k@
754.)	2860	ruo	$	ro	1183.)	1414	nin	$	n2

1186.)	1406	zan	$ zv
1210.)	1342	en	$ a)
1233.)	1289	lang	$ l(
1236.)	1278	cang	$ c(
1248.)	1245	zha	$ *
1258.)	1228	sa	$ s*
1263.)	1222	pen	$ p)
1267.)	1218	gua	$ g%
1278.)	1199	ruan	$ j7
1281.)	1193	gun	$ g:
1285.)	1191	ken	$ k)
1299.)	1164	zuan	$ z7
1300.)	1163	le	$ l?
1312.)	1143	ca	$ c*
1334.)	1110	rao	$ j+
1339.)	1104	peng	$ p#
1344.)	1100	chai	$ q9
1351.)	1079	beng	$ b#
1367.)	1045	zun	$ z:
1377.)	1026	rui	$ jw
1378.)	1025	guai	$ gy
1389.)	1015	qiong	$ k4
1390.)	1015	sen	$ s)
1394.)	1012	cui	$ cw
1432.)	952	kua	$ k%
1455.)	916	shuai	$ 5y
1470.)	896	die	$ de
1492.)	865	zhuo	$ \o
1529.)	834	piao	$ p@
1535.)	829	qia	$ k6
1540.)	822	teng	$ t#
1597.)	756	nuan	$ n7
1608.)	743	bin	$ b2
1664.)	673	shai	$ 59
1680.)	659	nen	$ n)
1686.)	655	ao	$ ++
1709.)	626	niao	$ n@
1769.)	578	shua	$ 5%
1774.)	574	fo	$ fe
1785.)	567	kui	$ kw
1813.)	542	sang	$ s(
1819.)	538	zang	$ z(
1846.)	512	keng	$ k#
1882.)	482	sou	$ s[
1949.)	438	diu	$ d8
1952.)	437	ang	$ a(
2009.)	397	lia	$ l6
2026.)	390	sao	$ s+
2069.)	369	tun	$ t:
2100.)	354	cuan	$ c7
2173.)	327	zei	$ z^
2264.)	291	miu	$ m8
2266.)	291	pou	$ p[
2267.)	290	cou	$ c[
2305.)	276	nang	$ n(
2406.)	243	weng	$ //
2514.)	212	yo	$ 8[
2488.)	219	nie	$ ne
2631.)	182	shuan	$ 57
2641.)	178	o	$ o?
2790.)	144	seng	$ s#
2963.)	114	pie	$ pe
3029.)	104	ga	$ g*
3069.)	100	nüe	$ n]
3341.)	73	cen	$ c)
3542.)	60	chuo	$ qo
3583.)	57	chuai	$ qy
3716.)	50	jiong	$ g4
3718.)	50	nuo	$ no
4005.)	37	zhuai	$ \y
4941.)	14	lo	$ l)
5708.)	7	tei	$ t^
5980.)	5	dia	$ d6
6271.)	4	nou	$ n[
6547.)	3	m	$ am
6853.)	2	kei	$ k^
7193.)	1	den	$ d)

Sounds without a character

chua, ei, eng, n, rua, shei, zhei

II.3. Number of characters represented by one syllable

The following list provides the number of characters a particular syllable represents according to Xinhua Zidian, 1980. The syllables are ordered from the highest numbers to the lowest numbers.

133	yi	34	e	25	lan
128	ji	34	ling	25	qing
106	yu	34	mi	25	tong
102	xi	33	pi	25	ya
97	fu	33	tan	25	zha
95	zhi	32	chan	24	chen
84	shi	32	cheng	24	ci
81	li	32	shen	24	xing
80	qi	32	xiang	24	zhang
73	jian	31	jue	24	zhe
70	yan	31	qiao	24	zheng
68	bi	31	ti	24	zhou
67	wei	31	xun	23	bu
63	ju	31	yun	23	duo
61	wu	30	dan	23	fen
55	jiao	30	fei	23	feng
55	jie	30	huan	23	lian
55	xian	30	huang	23	liu
54	zhu	30	kui	23	mu
52	lu	30	mei	23	quan
51	di	30	yang	23	ta
49	hu	30	yong	23	yue
49	hui	29	bei	23	zhuo
48	gu	29	fan	22	dai
48	xie	29	jiu	22	gou
46	jing	29	tang	22	lei
46	shu	29	wan	22	liao
45	bo	28	chang	22	lü
45	qian	28	gan	22	meng
45	yin	28	luo	22	qin
45	ying	28	mao	22	xia
45	you	28	qiu	21	ao
42	xu	28	tuo	21	xiu
41	zi	28	ye	21	zhao
40	si	27	ai	20	an
39	he	27	bao	20	chou
39	jin	27	guan	20	fang
39	yao	27	pu	20	gong
38	qu	26	ba	20	lao
37	chu	26	cha	20	ni
37	mo	26	lin	20	po
37	xiao	26	su	20	ru
37	zhen	26	xuan	20	she
36	chi	26	zhan	20	tao
36	jia	25	ban	20	ting
36	shan	25	bian	20	xin
36	yuan	25	da	19	dao
35	ge	25	dian	19	hong
35	gui	25	du	19	huo
35	han	25	hao	19	kan
35	ke	25	jiang	19	kuang

19	liang	14	geng	10	ben
19	long	14	kai	10	beng
19	man	14	lang	10	cu
19	peng	14	ming	10	duan
19	qiang	14	nian	10	dui
19	ren	14	qie	10	hang
19	tai	14	shang	10	kang
18	ding	14	sheng	10	luan
18	dun	13	bin	10	mai
18	guo	13	cai	10	mang
18	jun	13	cong	10	ning
18	mian	13	cuo	10	pai
18	min	13	dang	10	pang
18	sha	13	diao	10	tui
18	sui	13	er	10	zai
18	suo	13	fa	10	zhui
18	tian	13	gua	9	cao
18	wen	13	hai	9	che
18	zhong	13	kuai	9	ga
17	biao	13	lai	9	gao
17	dong	13	lie	9	le
17	lou	13	nao	9	lun
17	pan	13	pei	9	nan
17	ping	13	piao	9	niu
17	tu	13	shou	9	nong
17	zao	13	wang	9	tun
17	zuo	12	chong	9	xiong
16	die	12	chuan	9	za
16	hua	12	gai	9	zeng
16	ma	12	heng	9	zui
16	nie	12	hun	8	chai
16	rong	12	ou	8	huai
16	shao	12	que	8	kao
16	song	12	sou	8	kong
15	bang	12	xue	8	men
15	bing	12	zan	8	nuo
15	can	12	zhai	8	qiong
15	chao	12	zhuan	8	sa
15	cui	12	zong	8	san
15	dou	12	zu	8	shuo
15	gang	11	chui	8	teng
15	hou	11	chun	7	ce
15	juan	11	na	7	chuang
15	ku	11	nai	7	cuan
15	kun	11	pa	7	cun
15	la	11	pao	7	de
15	miao	11	pian	7	guang
15	tiao	11	pin	7	kou
15	wo	11	rang	7	kua
14	bai	11	wa	7	leng
14	deng	11	zhuang	7	mou

7	nu	3	ang	000	eng
7	ran	3	ca	000	n
7	rui	3	cen	000	rua
7	sao	3	chuai	000	shei
7	shuang	3	en	000	zhei
7	sun	3	kuan		
7	weng	3	m		
7	zang	3	nang		
7	ze	3	nei		
6	cang	3	ruan		
6	gun	3	run		
6	ka	3	shai		
6	niao	3	shua		
6	rou	3	suan		
6	sai	3	zhua		
6	se	2	cou		
6	shuai	2	fou		
6	zou	2	hei		
5	a	2	kei		
5	bie	2	lia		
5	ceng	2	lüe		
5	chuo	2	me		
5	gen	2	miu		
5	jiong	2	nen		
5	keng	2	niang		
5	mie	2	nüe		
5	ne	2	o		
5	qia	2	pen		
5	qun	2	re		
5	rao	2	reng		
5	ruo	2	yo		
5	sang	2	zen		
5	shui	1	dei		
5	shun	1	den		
5	tie	1	dia		
5	tou	1	diu		
5	zhun	1	fo		
5	zuan	1	gei		
5	zun	1	lo		
4	guai	1	neng		
4	ha	1	nin		
4	hen	1	nou		
4	ken	1	nuan		
4	kuo	1	ri		
4	nü	1	sen		
4	pie	1	seng		
4	pou	1	tei		
4	shuan	1	zei		
4	te	1	zhuai		
4	tuan	000	chua		
4	wai	000	ei		

II.4. Number of characters ordered under one graphic compound.

The following list provides the number of characters ordered under a particular graphic compound according to Xinhua Zidian, 1980. The graphic compounds are ordered from the highest numbers to the lowest numbers.

540	sandianshui (three drops)
479	zao (grass)
454	mu (tree)
452	kou (mouth)
398	shou (hand)
316	ren (man)
305	jin (gold)
230	yue (moon)
218	tu (earth)
211	si (silk-thread)
201	chong (insect)
193	xin (heart)
190	yan (language)
187	zhu (bamboo)
178	nü (women)
157	shan (mountain)
157	shi (stone)
151	yu (jade)
150	huo (fire)
144	chuo (walk)
144	zu (foot)
142	yi (illness)
137	yi (number one)
128	ri (sun)
120	niao (bird)
110	xin (heart)
109	pie (stroke)
108	yu (fish)
102	mu (eye)
98	quan (dog)
98	he (cereal)
92	bei (cowrie-shell)
91	yi (clothes)
90	mian (roof)
87	dao (knife)
87	ma (horse)
86	fu (hillock)
77	tou (shelter)
75	you (amphore)
72	che (cart)
71	guang (shelter)
71	ye (head)
71	men (door)
71	yi (district center)
68	shi (eat)
62	chi (go for a walk)
62	mi (rice)
62	yi (sicle)
60	jin (cloth)
59	tian (field)
57	li (strengh)
53	xue (cave)
52	da (big)
51	shi (venerate)
50	ba (eight)
50	ru (enter)
49	ge (halbard)
49	ge (hide)
49	gun (stick)
48	sui (drag)
48	chang (slope)
47	shi (ten)
47	shi (dead body)
46	niu (ox)
45	yu (rain)
43	wei (encloser)
39	zhou (boat)
39	min (container)
37	yang (sheep)
36	zhui (bird)
36	yu (feather)
36	gong (bow)
36	er (ear)
35	you (also)
34	dao (knife)
33	jian (see)
33	yi (clothes)
33	shi (literate)
33	bing (ice)
31	si (silk)
31	bao (hair)
30	huozi
29	wang (net)
29	zi (son)
28	xiao (small)
27	qian (exhausted)
26	er (lift)
26	gu (bone)
26	bai (white)
24	li (stand)
24	dian (dot)
24	zhua (claw)
24	qi (steam)
24	hei (black)
23	wei (leather)
22	zou (march)
22	er (two)
22	shui (water)
22	chi (teeth)
22	mao (hair)
22	wa (tile)
21	lu (deer)

21	xi (hide
21	shu (stick)
21	hu (tiger)
20	jin (gold)
20	cun (inch)
19	yan (language)
19	yue (speak)
19	fang (square)
19	feng (wind)
19	jiao (horn)
19	gui (spirit)
18	ji (snout)
17	zhi (halt)
17	bao (embrace)
16	bu (devine)
16	jiong (countryside)
16	zhi (follow)
16	zhi (follow)
15	zhi (wild pig/bear)
15	gong (work)
15	fou (jar)
15	xu (beard)
15	hu (family home)
15	si (private)
15	ji (small table)
15	jie (seal)
14	xi (evening)
14	shi (pig)
14	shi (arrow)
14	dai (wicked)
13	dou (beans)
13	shi
13	ji (personal)
12	jiu (mortar)
12	yu (brush)
12	shen (body)
12	pan (firewood)
12	shi (venerate)
11	shu (rat)
11	jin (pound)
11	mi (cover)
11	wen (literature)
10	wang (lame)
10	ma (hemp)
10	xi/xia (west/cover)
10	yi (arrow)
10	qi (he/her)
10	gong (together)
10	kan (hole)
10	pian (plank)
10	long (dragon)
10	yao (tender)
9	quan (dog)
9	pi (roll of cloth)
9	dou (fight)
9	pu (beat)
9	chen (Minister)
9	she (tongue)
9	xue (blood)
9	min (frog/toad)
8	mai (wheat)
8	ye (trade)
8	bi (nose)
8	pi (skin)
8	zi (oneself)
8	lu (rock)
8	chi (red)
7	bi (compare)
7	gen (decisive)
7	yin (go)
7	chen (time)
7	yong (use)
7	mao (lance)
7	fu (father)
7	mu (mother)
7	men (door)
7	gu (valley)
6	cai (choose)
6	li (village)
6	qing (green)
6	gua (melon)
5	che (shoot, spout)
5	yin (sound)
5	lao (old)
5	chuan (stream)

Appendix B.III.

Full initials		initials	Full Finals					
zh	= zhi	b	a	= a		uo	= wo
ch	= chi	p	o	= o		ue	= yue
sh	= shi	m	o	= e		an	= an
r	= ri	f	i	= yi		ang	= ang
z	= zi	d	u	= wu		en	= en
c	= ci	t	ü	= yu		eng	= eng
s	= si	n	ai	= ai		ian	= yan
g	= ji	l	ao	= ao		iang	= yang
x	= xi		ei	= ei		in	= yin
q	= qi		ou	= ou		ing	= ying
(m	= m)		ia	= ya		uan	= wan
(n	= n)		iao	= yao		un	= wen
			iu	= you		ong	= weng
			ua	= wa		uan	= yuan
			uai	= wai		un	= yun
			ui	= wei		iong	= yong
			uang	= wang		ie	= ye
						er	= er

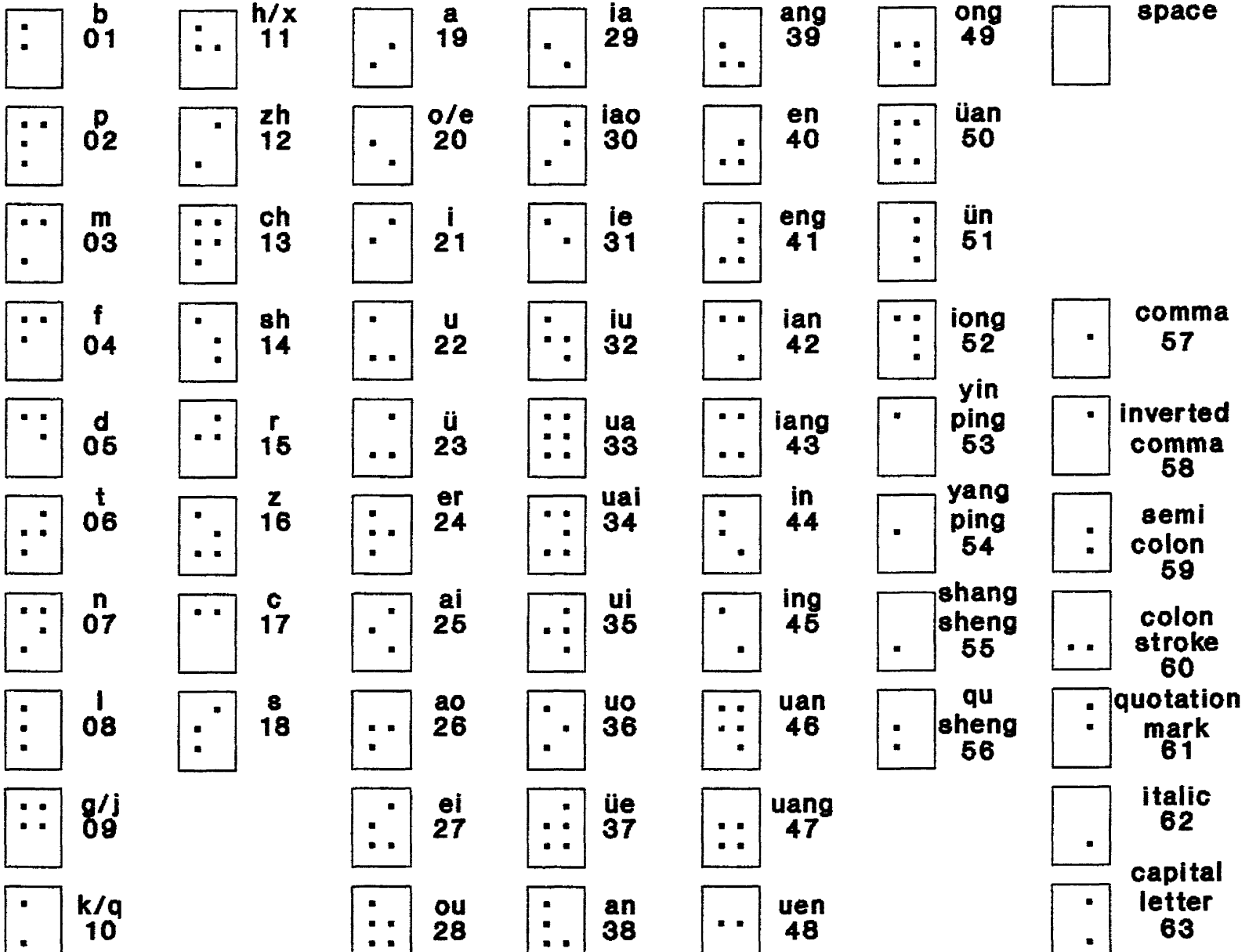
Appendix B.III.a

Restrictions	Exeptions	
g	m	ei
h	n	eng
k	r	o
		en
		ang
		uai
		a
		ua
		ong
		ou

B.III.b.

chu
chuai
chuan
chuang
chui
chun
chuo
cu
cuan
cui
cun
cuo
gu
guai
guan
guang
gui
gun
guo
hu
hua
huai
huan
huang
hui
hun
huo
jia
jian
jiang
jiao
jie
jin
jing
jiong
jiu
ju
juan
jue
junku
kua
kuai
kuan
kuang
kui
kun
kuo
qia
qian
qiang
qiao
qie
qin
qing
qiong
qiu
qu
quan
que
qun
shu
shua
shuai
shuan
shuang
shui
shun
shuo
su
suan
sui
sun
suo
xia
xian
xiang
xiao
xie
xin
xing
xiong
xiu
xu
xuan
xue
xun
zhu
zhua
zhuai
zhuan
zhuang
zhui
zhun
zhuo
zu
zuan
zui
zun
zuo

Decimal code for Braille cell forms



C. Terminology:

Terms are ordered according to their first appearances in the text.

Corpus of a Chinese character

The *Corpus* of a Chinese character is the visual appearance of a Chinese character.

Geist of a Chinese character

Geist: German philosophical term often used to describe the opposite of material being. The *Geist* of the character is everything that relates to a character, everything that is not visually apparent but still belongs to the character, for example lexical compounds, ASCII code and so forth.

Graphic components

Basic combinations of strokes which is used to order Chinese characters.

Lexical compounds

Word-like combinations with other characters. For example: the Chinese character for car, *che* (車) combined with the Chinese character for fire, *huo* (火) in the right order reads *huoche* (火車) which in modern Chinese stands for "railway train".

Lexical phrases

Combination with a larger number of other characters, as in idioms or in lines of poems, songs, or well known philosophical and political phrases.

Component of a character

A component of a character is any part of it that on its own or in combination with others contributes to the being of the character.

Chinese Phonetic Braille

Chinese Phonetic Braille systems are Chinese writing systems for visually impaired persons which use Braille cell forms and are based on Chinese language. Chinese Phonetic Braille systems bear no direct relation to Chinese character script.

Braille

Braille: A system of printing and writing consisting of tactually distinguishable raised dot patterns which represent the elements of a language or other graphic symbology.

Six-dot Braille

A writing system consisting of haptically distinguishable raised dot patterns with six available dots.

Eight-dot Braille

A writing system consisting of haptically distinguishable raised dot patterns with eight available dots.

Braille cell

The space in which one full set of Braille dots can be placed.

Braille cell form

Any of the different dot configurations.

Braille unit

Any combination of Braille cells separated from another by a space.

Braille block

Any combination of Braille cells used as a meaningful part in a Braille unit but not separated by a space.

Ink-print

Ink-print is the term to describe printed matter for the sighted.

Braille contractions

Braille contractions are Braille cell forms or combination of Braille cell forms designed or designated to save space and reduce reading and writing time.

Specialist schools for visually impaired students

Schools where only visually impaired students are educated, which means they are separated from main stream education.

Xianxing mangwen

Chinese Phonetic Braille system, currently used in the People's Republic of China.

Daidiao shuangpin

Chinese Phonetic Braille system, to be implemented instead of *xianxing mangwen* in the People's Republic of China.

Guoyu dianzi

Chinese Phonetic Braille system currently used in Taiwan.

Zhongwen yueyin dianzi

Chinese Phonetic Braille system currently used in Hong Kong.

Chinese Character Braille

Chinese Character Braille systems are writing systems for visually impaired persons which use Braille cell forms and are based on direct representation of Chinese character script.

Prototype 1 Chinese Character Braille

Prototype 1 Chinese Character Braille is an experimental introduction of a prototype Chinese Character Braille explained in Chapter 4.

Verbal identification

Explanations connected to individual Chinese characters which are used verbally.

Chinese Character Braille Prototype 2, in short CCB2

Chinese Character Braille Prototype 2 is an experimental introduction of a prototype Chinese Character Braille explained in Chapter 5.